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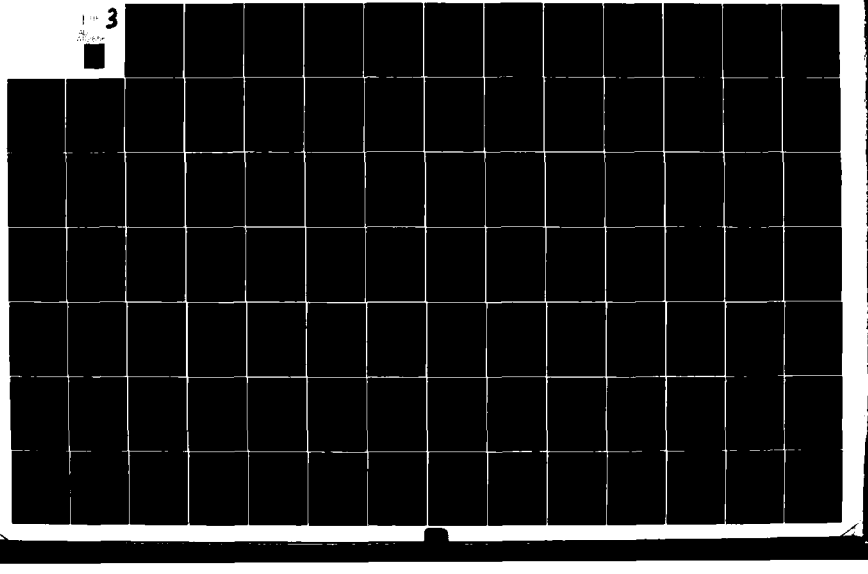

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DIVWAG MODEL DOCUMENTATION
VOLUME III
PLANNER/USER MANUAL

ACN 21704

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ABSTRACT

This documentation provides a complete description of the Division War Game (DIVWAG) Model as it exists on 1 April 1976. The documentation is composed of an Executive Summary (Volume I), an Analyst/Programmer Manual (Volume II), and the Planner/User Manual (Volume III). Described within the volumes are the model design and development; application; capabilities; limitations; facility, equipment, and personnel requirements; data input requirements; mathematical and logical processes; program descriptions· output descriptions; user instructions; and diagnostic messages. This documentation was originally produced in April 1973 by Computer Sciences Corporation (CSC) under Contract DAAG 11-70-0875.

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FIGURES

FIGURES (Continued)

CHAPTER 1

INTRODUCTION

1. PURPOSE. The purpose of this volume is to provide prospective users of the Division War Game (DIVWAG) Model with the background, description, procedures, and techniques necessary for understanding and operating the model in a division force evaluation.

2. SCOPE. This volume provides the procedures, rules, and techniques for the operational use of the DIVWAG Model in the conduct of an analytical task. This chapter provides background information relative to war gaming and a nontechnical description of the DIVWAG system necessary for understanding the computer assistance provided in the war game. Chapter 2 describes game operations, exclusive of the dynamic game play. Chapter 3 details the DIVWAG game period operational sequence and describes the dynamic play operations for applying DIVWAG.

3. BACKGROUND:

a. Description of a Game:

(1) A game is a form of human endeavor, sometimes recreational, distinguished from other forms of activity by having rules and a payoff. In return for adhering to the rules, the player receives a reward. The rules are arbitrary, and many payoff schemes exist. Payoff can be determined by chance, as in dice or roulette; a function of skill, as in stud poker, business, or football; or, in the British sense, obtained from playing the game with class (win or lose), as in war. Some games are personally competitive, one player's gain being another player's loss. Competition adds to player interest; however, the most interesting games, with all due respect to the adherents of craps, roulette, and basketball, are the intellectual ones.

(2) Intellectual games have extensions in time, both past and future. Each action by a player produces a new state (situation), and each action is a function of the existing state; therefore, each action by a player is dependent on all the past actions taken by players. In addition, a player is required to project into the future the events that his action will unleash. Reward accrues to the player who can most successfully accomplish the projection. The game becomes an intricate, changing tapestry, which takes on the form of all the past decisions of the players. Chess, war, politics, and billiards are examples of games with extensions in time.

b. Characteristics of a War Game:

(1) A war game is a game having as its goal the replication of one or more of the manifestations of war; that is, the states through which the game passes should be similar, to some degree of detail, to situations encountered in war. The generation of this similarity is accomplished by requiring that the game rules and payoff calculations interact in a way that transitions a starting state, assumed to be realistic, to successive realistic states. Each action by a game player, done in accordance with the game rules, results in a payoff calculation, which in turn produces a new game state. The cycle then repeats (Figure 1-1).

(2) Identification of the rules constitutes a problem in war gaming. If the rules were immutable, they could be written down and machines taught to play a passable game.[1] This technique is, in fact, used for tiny wars; and simulations, untouched by human hands, come into their own. For grand wars, however, some of the rules for the replicating game are expressed as constraints on player actions. This expression of constraints takes the form of player conformity to what he and the other players regard as generally accepted normal behavior. Normal behavior may admit very few choices for a player decision, or alternatively, a continuous band of choices.

(3) The other rules, those which do not constrain player action, concern translating the existing situation plus the player decision into the next situation. It is important for the player to understand these rules; otherwise, he will have no appreciation of the consequences of his actions, and the final game situation will be nothing more than a random event. It is axiomatic among those who devise the rules for translating the game situation plus decisions into the next situation (i.e., model builders) that players should not know how this is done. It needs to be understood that the requirement for such an axiom implies subterfuge on the part of model builders.

(4) Although machines can be taught to play games, it is generally accepted that use of the word "game" implies human participation. Since some games are used, not for entertainment, but for the study of war, an understanding of the merits of simulations (machine games) and war games (human gamers) becomes necessary. There are four valid reasons for using a human player in the replication of war:

. The player is to be trained.

. A human player is innovative.

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1. Even if the rules can be written down, there is no guarantee that a machine can be taught to play a good game. A prime example is chess. The heuristics of searching the future for a good move are inadequately understood even for this ancient and well-studied game.

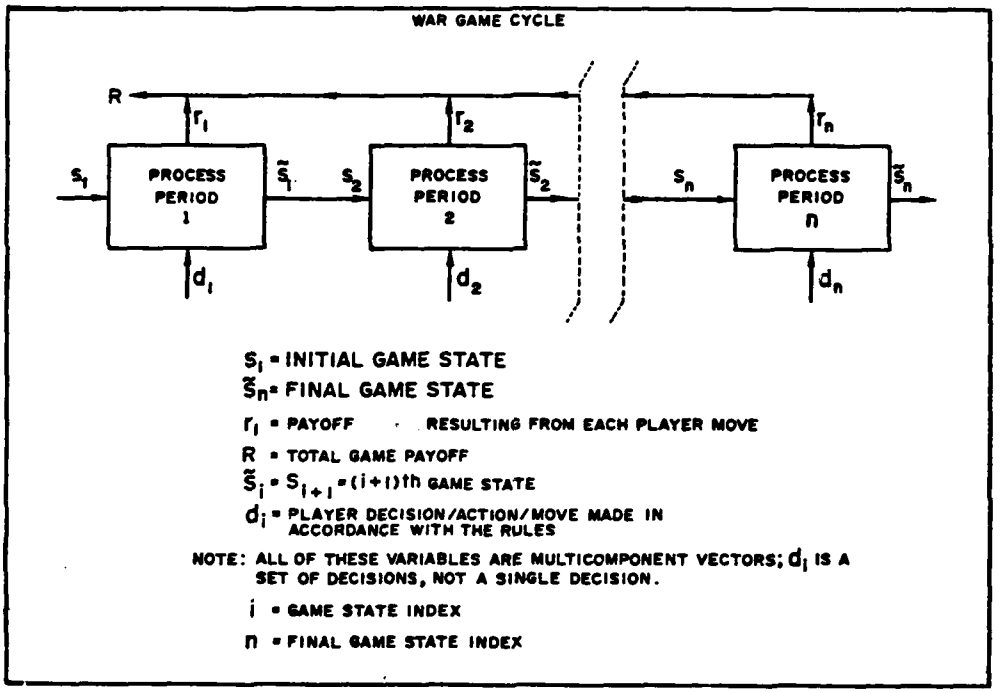

Figure 1-1. War Game Cycle

- The player rules cannot be formalized to a degree adequate for programming a machine.

- The player rules are so involved that machine programming becomes inefficient and wasteful.

The training of a player is a valid reason only for that class of games designed especially for training purposes. The second reason, the requirement for innovation, has come to be discouraged, the result of a level of sophistication requiring that a series of games be absolutely comparable one with another rather than a sequence in an optimization scheme. Thus, the remaining two reasons for using human players in war gaming are operative; the human player is used from necessity rather than choice. The return for simplifying the model builder's task apparently overshadows the difficulties generated for the person responsible for making comparisons among games.

(5) In practice the necessity for using a human does not exclude the machine player. The process of transitioning a game from one state to the next is gradually being taken over by computers, and it is natural to let the machine play small games and eliminate some of the arbitrary rules.[2] The result of this trend is affecting the design of war games. More and more the design of a game is becoming a matter of selecting the man-machine interface echelon. Above some echelon, the man makes the decisions; below, the machine makes the decisions.

(6) Despite the ambiguities introduced by a human player, a war game is a valuable analytical procedure. Problems that can be treated in no other way can be studied in a war game. This class includes large problems, complex problems, and problems that are not well understood. The production of a sequence of game states amounts to the fragmenting of a large problem into a set of smaller interconnected problems, and the decisions required at each game state focus the attention of the player on the important elements of the problem. An effective war game produces a number of subproblems, which may be much more amenable to analysis.

(7) A significant characteristic of a war game is that its successful conduct requires a tremendous amount of communication. Often this communication must take place among players with diverse skills and backgrounds. The analyst must explain to the player why he must know certain things, the player must explain military tactics to the rule keeper (model builder), and the whole game must be explained to sponsors who were not players.

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2. The elimination of arbitrary rules is good; however, in many cases the rules are based on experience. Replacement of the experience base with a poorly taught machine is not good.

(8) War games also have disadvantages, including:

. Results are replicable only with great difficulty.

. Value of a game is a direct function of the skill of the game team. An effective team is difficult to build, and there are no mediocre ones. They are either good or very bad.

. Results are more subject to controversy than those generated by machines. (A computer's subjective judgments are more easily concealed.)

. A game is more subject to external pressure. (Computer decisions can be manipulated also, but only overtly and with difficulty.)

c. Classification of War Games. War games are classified by describing the purpose, the form, and the information constraint.

(1) The purpose of a game may be to train players, to test operational plans, or to research the composition and conduct of forces used in war.[3]

(2) The form of a game may be either free or rigid. These terms are historical and refer to the relative dependence of the game on formalized rules. A rigid game depends entirely on rules. Transition of the game from one state to the other is determined from tables and calculations. The results of player decisions are determined by reference to rules. Opposed to the rigid game is the free game. In the free game a controller decides i- :es solely on the basis of his judgment. A free game is very fast, more fun, and possibly, nearly as effective as a rigid game.[4] Most war games are a mixture of free and rigid, with a recent steep trend toward the use of rigid games in research.

(3) Classification of a game according to information constraint determines what the players are allowed to know about each other. In a completely open game total information is provided each player. In a closed game only certain elements of the game state of the opposing player are known. Game rules decide what information to provide. It can become a game refinement to let these rules correspond to the information-collecting

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3. A more basic purpose for a war game was expressed by an unnamed WWII General of the Greater German Empire who stated, "The purpose of the exercise was to provide the opportunity for raising and discussing controversial problems with a selected and critical circle." (War Games, Office of Military History, Department of the Army, Washington, D.C., 1952.)

4. J.P. Young, A Survey of Historical Developments in War Games, ORO-SP-98, Operations Research Office, Bethesda, Maryland, 1959.

capability of the player. An open game is advantageous when speed of play or increased management control is required. Although information constraint and speed of play or management control do not appear to be correlated, they are in fact related inexorably for most modern war games. Intelligence play has become an absolute requirement for a war game. Even if a player has 100 percent knowledge of his opponent, an open game, he can act only on the knowledge that he might reasonably be expected to gain in real life. As a result, there is no apparent difference between the events of an open game and the events of a closed game. As a practical matter the difference occurs in the way the gaming staff is organized.

(a) In organizing for an open game, the staff controlling the game and the player staffs are formed into a single committee chaired by the game director. The players become functional specialists whose purpose is to offer advice. The game decision base becomes flexible and, in the extreme, may consist only of the game director. The result of this organization and the resultant narrowed decision base is a reduction in the requirement for multipoint communication, always a time consumer, and a reduction in the occurrence of the unexpected. The game operates under the guidance of a single intellect. Player sparring and unnecessary activities are eliminated, and the operation is very efficient. An open game, however, has all the characteristics of playing Monopoly with oneself. It is very hard to be creative and very easy to be bored and mediocre. Much can be learned of rules, but very seldom can the intellect be really challenged. An open game is an effective user of time and things, and a very inadequate user of human resources.

(b) The closed game is an almost exact contrapositive of the open game. What the closed game does well, the open game does not, and vice versa. A staff that does well on open games will not do well on closed games. The converse is also true. A closed game is more realistic for the players. They also have their own professionalism at stake. A closed game is generally accompanied by much fire, smoke, and friction, the result of breakdowns in communication. The controlling staff has its work cut out for it, and the game management needs patience. The payoff for this kind of effort is many interesting problems and a great deal of insight. Closed games, therefore, are ideal for optimization schema.

d. Computer-assisted War Gaming:

(1) There are two types of computer-assisted war games, which may be referred to as Type A and Type B.

(a) In the Type A game the computer functions only as a very efficient bookkeeper. Its functions are limited to elementary computations and the formatting of feedback data. Decision logic is not employed; thus, the personnel employed in the game retain their decision-making responsibilities.

(b) In a Type B war game the computer takes on all or some of the responsibility for controlling the action of the game and plays some parts of the game. Extensive decision logic is used. Development of Type B games has the goal of restricting human participation to either key issues (those requiring innovation) or decisions absolutely requiring human input (those for which logic is not programmable).

(2) A pure Type A or Type B war game does not exist. Existent games are a mixture; however, at the present time most games are predominantly Type A. The rules and calculations of what is philosophically a hand-operated game are programmed, and an interface between players and machine is defined. In most cases rules are extended and more detail considered because of the increased manipulative capability of the computer. This extension of the rules may take the form of incorporating a simulation into the game. In this case the simulation is merely an elegant formulation of a rule. The game may still be of Type A, because a simulation may or may not describe faithfully a situation requiring a representation of human decision making.

(a) Decision making in a simulation accomplished by using an average decision, a most probable decision, or the selection of a decision in a random fashion from a stated distribution is a disservice to the real thing. When a chain of such decisions is linked together, reality may become the victim.[5]

(b) When a decision is represented by a rule/simulation it is assumed that the stated result always occurs. For many situations this is true; e.g., the squad leader may not have many choices; however, a brigade commander has many options. A simulation of brigade activities, used so that a human player is required to consider only those decisions required at the division echelon, must consider decisions logically.

e. Use of War Games:

(1) War games are the primary analytical tools to assist in the orderly examination of conflict situations involving military units and systems. The entire framework of a war game is open for inspection by a force planner so that the applicability of game results to hardware procurement and organizational development can be studied in detail.

(2) War games can support research in a variety of ways. They can, even in their formative stages, provide considerable broad general insight into critical problems in study areas; they can generate distributions of outcomes of play of specific situations; and they can function as pseudo-experiments, producing data for analysis after the plays are completed.

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5. Such functions are termed pathologically bimodal. In translation this term means that the simulation is schizophrenic. The result has an ill-defined relationship to the input.

(3) The analytic use of a war game is possible only when efforts have been made to ensure that the required elements of game record, or data, are available. Given a basic operational structure of movement, contact, and battle between the opposing resolved units, the approach is one of introducing detailed simulations of the real world events to be studied. These simulations result from cooperative effort between the game staff and the analysts of the proponent agency. Research objectives are used to develop the simulation models, rules of play, and assessment procedures that ensure events pertinent to the problems do occur in the course of play and that the desired data for analysis are taken. One criticism that has been leveled against the conduct of war games is that the analysts have conspicuously failed to reap the rewards in doing analytic research based on data from their games. A point easily lost is that the play of the war game merely produces data for detailed analysis. The data produced from the play of the war game must be interpreted and evaluated to produce insights, findings, and conclusions that are valid for the situation being simulated in the game; reliable in the sense that repeated play of the same plans and set of conditions would yield similar results within the limits of chance variation; and useful for predicting results for related situations. The actual results of the game must be analyzed, and the analysis must also appraise the validity of the input data, the rules and assumptions made, the availability of resources consumed, and the strategy and tactics utilized by the player teams. Such analysis can be a great source of information to the sponsor of the study effort and can help justify the expense of the game. Applying a structural methodology to the output of the war game takes it out of the realm of philosophy and back into the science of operations research.

4. SYSTEM DESCRIPTION. The DIVWAG system is described in this paragraph in terms of its objective, its capabilities, and its components.

a. System Objective. The DIVWAG Model was developed as a computer-assisted war gaming system for use in simulating military interactions between opposing division-size forces and their major elements, with outputs permitting evaluation and comparison of the combat effectiveness of such division forces. The DIVWAG Model objective is to provide means for determining the impact on force effectiveness of changes in the mixes of major weapons and other systems The DIVWAG Model permits two-sided simulations. The games using the DIVWAG Model can be open, semi-open, or closed. The games will be basically rigid, but the model can be operated with semi-rigid intelligence and special weapons assessment. Resolution is partially adjustable. Time resolution may be as small as a hundredth of a minute (0.01 minute), space resolution as small as one meter, and unit resolution as small as one individual; however, for practical gaming purposes, unit resolution is on the order of a battalion, depending on terrain scale and size forces being gamed.

b. Model Capabilities. The model capabilities are discussed in terms of operational capabilities and operational scope.

(1) Operational Capabilities. The DIVWAG Model has the following operational capabilities:

(a) Producing data for use in evaluating effectiveness of forces composed of maneuver units and their associated combat support and combat service support units.

(b) Producing detailed quantitative data for use in comparing the effectiveness of the alternative forces.

(c) Simulating high and mid-intensity conflict (nuclear and conventional war).

(2) Operational Scope. The DIVWAG Model scope is defined in terms of command levels, military services, types of operations, geographical areas of operations, rate of operation, and combat functions.

(a) Command Levels. The DIVWAG Model has been designed to produce data to evaluate division forces; i.e., a division plus an appropriate slice of corps or field army troops. There is explicit representation of the task organization of the forces. Echelons of command are defined, and reports are prepared that reflect the status of each command echelon and include the aggregated status of all subordinate units. Communications are simulated between division, brigade/regiment, and battalion command units. A total of 1000 units can be played, divided among Red and Blue forces. These units must be structured into task organizations for each force.

(b) Military Services. The DIVWAG Model has been designed to accommodate and integrate all types of land forces (e.g., armored, mechanized, and airmobile) and supporting tactical air forces.

(c) Types of Operations. The DIVWAG Model provides for representation of the major types of military operations; i.e., offensive, defensive, retrograde (delay/withdrawal), covering force, and movement. In addition the model is capable of simulating high and mid-intensity conflict (nuclear and conventional war).

(d) Geographical Area of Operations. The DIVWAG Model can accommodate rectangular geographical areas as large as 8,000 kilometers on a side. The system is limited in its application to worldwide geography only by availability of appropriate input data.

(e) Rate of Operation. The rate of operation of the DIVWAG war game is not firmly established. It is estimated that the simulation model can produce game period turnaround data in a 2:1 ratio of computer time to combat time simulated for a relatively straightforward combat situation at a battalion level of resolution. Actual timing is a function of the level of resolution being gamed, the number of units being gamed, the level of military activity portrayed, and the nature of other computer jobs on the system when

the model is being used in a multiprogramming environment. Considering the time required for period turnaround, a real time to game time pace of approximately 5:1 is considered reasonably attainable for gaming at a sufficient level of complexity to provide useful results.

(f) Combat Functions. The DIVWAG Model can address the following functions and evaluate the contribution to force effectiveness of varying the mixes of related elements:

1. Intelligence functions; surveillance and target acquisition.

2. Command, control, and communications functions; decision and communications delay times.

3. Firepower functions.

4. Mobility functions; aerial, ground, and firepower mobility.

5. Combat service support functions; supply and transportation, loss, expenditure, and consumption rates; personnel replacement.

c. System Components. The DIVWAG system comprises four components: facilities, equipment, personnel, and the gaming model.

(1) Facilities. The USACDC War Game Facility, Building 391, at Fort Leavenworth, Kansas, contains six fully equipped game rooms and other related supporting facilities; see Figure 1-2 for floor plan. The US Army Training and Doctrine Command Data Processing Field Office (TRADOC DPFO) is located in Building 136, approximately 1 mile from the War Game Facility. and the Post Data Processing Facility (PDPF) in Building 50 at about the same distance.

(2) Equipment. Three general types of equipment are required: administrative, automatic data processing, and visual data display.

(a) Administrative Equipment. Routine types of administrative equipment are provided by the War Game Facility; e.g., electric typewriters, reproduction equipment (Xerox and Ozalid machines). Related supplies are required.

(b) Automatic Data Processing Equipment. The DIVWAG Model software programs are written in FORTRAN for use in the CDC 6500 SCOPE Operating System. Required computer and auxiliary equipment are shown in Figure 1-3.

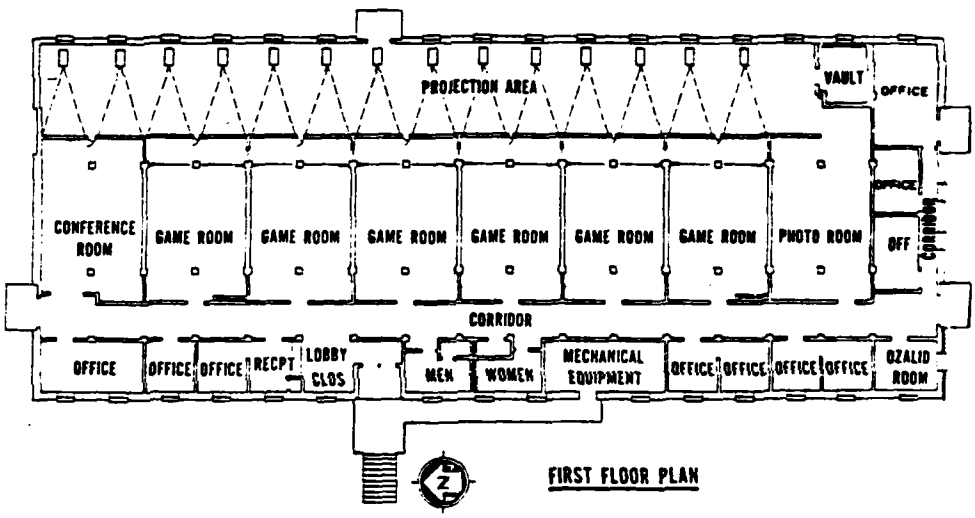

Figure 1-2. War Game Facility Floor Plan

Equipment	Requirement
Core storage capacity	124,000 words (octal)
Magnetic tape drives	2
Magnetic disk capacity	3,000,000 words (decimal)
Printer	1
Card reader	1
Software features	FORTRAN compiler (ANSI)* Overlay loader (2 levels) Mass storage input/output

*American National Standards Institute, Inc.

Figure 1-3. DIVWAG Computer Configuration

One card punch machine and one verifier are available in the War Game Facility. The other required equipments are available in either the TRADOC DPFO or the PDPF. Related supplies are required.

(c) Visual Data Display Equipment. Each game room and the conference room in the War Game Facility is equipped with two projection stations and two 7 ft x 8 ft translucent glass screens. The photographic room is equipped for photography and production of transparencies. Related maps and photographic supplies are required.

(3) Personnel. The personnel necessary for the effective and efficient operation of DIVWAG are organized as shown in Figure 1-4. The DIVWAG organization consists of a directorate and four operating elements. General functions of these elements are indicated below.

(a) Directorate. The Directorate, consisting of the Game Director and a Deputy Director/Technical Advisor, provides operational and technical direction for the war game staff and establishes operating policies. The Directorate prepares the Game Plan which provides overall guidance for the conduct of the war game.

(b) Model Maintenance Team. The model maintenance team operates, maintains, and modifies the DIVWAG Model as required to meet gaming requirements and to permit effective dynamic gaming. In addition this team advises the gaming staff, as necessary, on the technical rules of the DIVWAG Model.

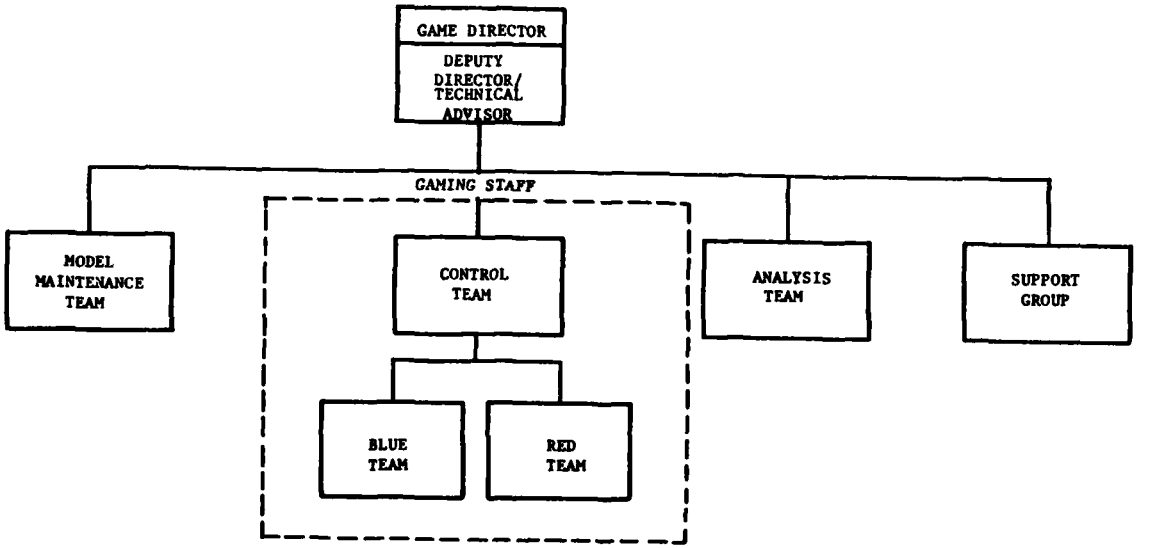

Figure 1-4. Organization for Utilizing DIVWAG

(c) Gaming Staff. The gaming staff, outlined by dashed lines in Figure 1-4, consists of control and player (Blue and Red) teams. Normally, the gaming staff as depicted in Figure 1-4 can play one open game.

1. Control Team. The control team is the Game Director's staff and consists of the chief controller and the Red and Blue controllers. The control team consists of personnel who participate in the play of a war game with the responsibility of controlling the play in accordance with the rules and predetermined objectives through arbitration and assessment of the actions and interactions of the players. In addition, the technical aides who assist the gaming staff in the posting of maps, coding of data processing cards, and maintenance of game records are provided from the control team.

2. Player Teams. The player teams, consisting of Red and Blue players, are the participants in a war game who are not members of the control team and who play the roles of a real world commander or staff officers of a military unit or units.

(d) Analysis Team. The analysis team consisting of operations research/systems analysis (OR/SA) specialists prepares the Analysis Plan and conducts the analysis described therein. This group identifies requirements for side analysis and ensures that the appropriate data are being produced through the conduct of the game for an evaluation of the game objectives.

(e) Support Group. The support group provides the bulk of permanent staffing required for the administrative and logistical support of the gaming effort. This support consists of keypunching, typing, graphical services, administration, and security.

d. Gaming Model. Functionally the DIVWAG Model is a dual system; it functions physically/electronically as a data processing system and, at the same time, it functions in simulation as a military combat system. To be complete, a description of the model must consider both aspects. The DIVWAG Model is described herein in terms of its data processing functional components and its military simulation functional capabilities.

(1) Data Processing Functional Components. The DIVWAG software is divided functionally into five processors that communicate with each other through common files and records. Designations and functions of these processors are:

(a) Constant Data Input Processor. The Constant Data Input Processor receives data on cards, edits the data, and assembles the data onto tape and disk files.

(b) Orders Input Processor. The Orders Input Processor receives player operational orders in semi-military language and processes these orders into detailed instructions to the units simulated.

(c) Period Processor. The Period Processor receives translated player orders and simulates the military action.

(d) Period Output Processor. The Period Output Processor receives results from the Period Processor and compiles specific reports and gross summary reports.

(e) Analysis Output Processor. The Analysis Output Processor receives detailed data from the Period Processor as period history tapes; retrieves, arrays, and performs the statistical analysis of the data; and outputs the arrayed data in specified formats.

(2) Military Simulation Functional Capabilities. The Period Processor simulates an extremely broad and flexible spectrum of military activity through four categories of models (intelligence and control, firepower, mobility, and combat service support). The models are described individually in the following subparagraphs.

(a) Intelligence and Control (INC). This model provides the quantitative data necessary for evaluation of the contribution of sensor mixes to force effectiveness. It integrates the closely related functions of surveillance; target acquisition; combat intelligence; and command, control, and communications. Gamers are permitted to input intelligence from sources not simulated by model components. The information obtained from sensors and from gamer input is processed and used automatically by the INC Model to make requests for fire support on acquired targets. Fire missions are requested from available attack helicopters, Air Force close air support (CAS), or ground-based artillery by use of a set of decision rules, according to the situation. Sensor information is also converted into general intelligence by this model to produce a summary report at the end of each game period. The summary outlines the current status of what may be known at division level concerning the size, type, and location of the enemy forces in the battle area. This report is to aid the gamer in preparing orders for the next game period. The INC Model consists of three interrelated submodels: Collection, Processing, and Decision. The military functions simulated by the INC Model are summarized below and include:

1. Sensing and Reporting. The capabilities of individual ground and aerial sensors are considered to simulate the detection and collection of information or intelligence on units of the opposing force and the summarizing of such information into sensing reports, which enter the intelligence chain. Both target and nontarget intelligence are simulated. Type sensors modeled include MTI radar, UGS fields, countermortar and counterbattery radar, air defense radar, visual observers in LOH and fixed wing reconnaissance aircraft, surveillance aircraft (Mohawk type) with MTI radar capability, and high performance reconnaissance aircraft with visual and various photographic capabilities.

2. Time Delays. The model introduces separate delays for time consumed in each of the principal steps: intelligence collection, intelligence analysis, routing, and use of the information in decisions.

3. Development of Targets for Fire Missions. A separate channel for development of target intelligence is simulated by the model. This channel provides acquired targets for fire missions without the relatively long delays involved in general intelligence processing.

4. Intelligence Analysis and File Maintenance. Comparison of a new report with information already in the intelligence files is simulated, and if reports relate to the same unit they are consolidated. The existence of new units or parent units can be deduced. Intelligence analysis centers are simulated for each unit at maneuver battalion, brigade or regiment, and division levels. Files are designed to stay within the limits of 10, 20, and 100 reports, respectively, for these three echelons.

5. Decisions on Information/Intelligence Flow and Requests for Fire Support. The routing of information or intelligence among intelligence analysis centers and command elements at the three echelons is simulated with the use of a flow structure and set of routing criteria, according to the information in each report. A similar set of criteria is used to determine whether a target qualifies for fire support and what type of fire support (attack helicopter, TACAIR, ground-based artillery) will be requested.

6. Contents of Intelligence Report. The end-of-period contents of the division intelligence file are used for this report. Each report that met criteria to reach this file and was not discarded from the file in favor of a more recent record or consolidated into a record of a parent unit is reflected in the Intelligence Report. Items of estimated information given in the report for each opposing unit in this intelligence file include size, activity, type, direction of last move, time last sensed, and number of sensings attributed to this unit.

(b) Firepower Models. The firepower models provide the quantitative data necessary for evaluation of force effectiveness as a function of changes in mixes and types of major weapon systems. The models integrate all aspects of mid or high intensity combat where interaction of opposing forces may occur and result in personnel or materiel losses. The firepower models coordinate and integrate the effectiveness of combined arms teams by modifying assessment routines for high attrition events to account for concurrent and parallel killing capabilities. For example, when units are engaged in combat, kills are related to the number of fire elements on opposing sides. Should an attack helicopter fire team make an attack during a ground combat cycle, the ground combat cycle will be interrupted immediately prior to the helicopter attack, the status of the units in ground combat will be updated to that moment, the effects of the helicopter attack on the current

ground combat unit's status will be assessed, and the ground combat cycle will be resumed. The same assessment technique is followed for other interfacing firepower activities. Five models simulate the firepower function: Ground Combat, Area Fire, Nuclear Assessment, Air Ground Engagement, and TACFIRE. Each of the first four of these models assesses damage inflicted and produces loss, expenditure rate, and consumption data for use in evaluating the supply and transportation systems. The TACFIRE Model works in conjunction with the Area Fire Model to schedule fire on targets of opportunity.

1. Ground Combat Model:

a. The Ground Combat Model represents the interaction between the direct fire weapons of opposing maneuver units engaged in ground combat.

b. The model represents the interaction and the effects of weapons of cross-reinforced units. Combat power may be enhanced by employing combined-arm forces against the enemy. The effectiveness of the maneuver unit is largely dependent on the combination and coordination of weapon systems within the unit. The distance of separation of weapon systems is limited so that mutual support is possible when weapon density permits.

c. The impact of the environment is represented by the model. All movement in ground combat is subject to the constraints imposed by the environment wherein ability to move forces by ground is degraded by the effects of adverse weather, terrain, and visibility. The application of firepower is largely controlled by the environment since effectiveness of each weapon system is limited by its associated target acquisition capabilities. Target acquisition cannot occur unless line of sight exists between the observer and target. Line of sight may be severely limited due to terrain roughness, vegetation, and forestation. A firer may lose line of sight on a moving target before firing a round. A moving target may drop out of line of sight during the time of flight of the round. Target acquisition is limited by visibility, whether due to adverse weather or night combat operations. Under conditions of reduced visibility, target acquisition is enhanced by the employment of night vision equipment.

d. The interaction of each maneuver unit with the enemy is considered by the model in terms of a maneuver unit's effectiveness and vulnerability. The maneuver unit's effectiveness is influenced by the level of activity. As the level of activity increases, more weapon systems can acquire targets. As individual moving weapon systems stop to fire, the signature (i.e., evidence of that weapon firing) increases with the level of activity. The maneuver unit's vulnerability is influenced by the level of activity. A firing weapon system may disclose its position and become a target for enemy fire.

e. The Ground Combat Model relies heavily on the existence of data to describe weapon/ammunition effectiveness against varying target types in a combat situation. The model also requires adequate data to describe the target acquisition capabilities of all employed sensor types other than unaided vision.

2. Area Fire and TACFIRE Models. The Area Fire and TACFIRE Models simulate the scheduling of nonnuclear munitions for area fires, and delivery and assessment of results of nonnuclear fires. Area fire events are generated by two methods. First, gamers issue fire orders prior to the engagement period for fire with specific ammunition at specific coordinates. Second, during the engagement period target information is developed by the Intelligence and Control Model with a request for nonnuclear artillery fire, and the TACFIRE Model automatically schedules the required fire missions for the fire units. The automatic mode is referred to as the TACFIRE mode. Targets in this mode consist of targets of opportunity and are limited to those enemy units detected and processed by the Intelligence and Control Model. Fire units are battalion or battery size, and integral fire units are used in attacking area fire targets. The fire units are constrained by range limitations, volley firing times, number of tubes or rails per fire unit, and weapons/munitions availability. A target threat priority value ranging from one to nine is assigned to each area fire target, and is based upon its estimated size, type, activity, range, and the tactical doctrine used in artillery employment for the particular game. Priority one is a higher priority than priority two, etc. If a backlog of targets exists, targets are engaged in highest priority order. The Area Fire routines are separated into three functional classes: scheduling, delivery, and assessment. Most of the routines for the automatic TACFIRE mode are concerned with scheduling of fires. The delivery routines deliver the munitions on target and determine units whose presence in the impact area will require assessments. The assessment routines then calculate the effects of the fire events, based on number of rounds fired, lethal area of nonnuclear munitions, dimensions of the target, number and density of target elements, and target vulnerability. The assessment routine makes adjustments in target personnel and equipment to reflect losses and in the fire unit's munitions on hand to reflect expenditures.

3. Nuclear Assessment Model. The Nuclear Assessment Model simulates the delivery of and the assessment of results of tactical nuclear fires. All nuclear fires are conducted in response to gamer fire orders, issued prior to the simulated engagement period. The gamer fire order specifies the unit to fire, weapon and munition to fire, yield, height of burst (if controllable), and designated ground zero. Thus, all planning of nuclear fires must be carried out by the gamer prior to an engagement period. In response to a nuclear fire order, the Nuclear Assessment Model simulates the actual firing, the nuclear detonation, and the assessment of effects against all units as well as on obstacles and facilities within the effects area of the round. The detonation and effects of atomic demolition munitions (ADM) are also simulated by the model. Simulated effects include those due to blast, prompt nuclear and thermal radiation, and delayed effects due to induced radiation. Fallout effects are not simulated.

4. Air Ground Engagement Model. The Air Ground Engagement Model simulates for both opposing forces all air-to-ground and ground-to-air interactions falling within the definition of close air support (CAS) and otherwise directly related to ground combat operations. These operations include aircraft fires provided by other Services, and Army aircraft delivering direct aerial fires (DAF). The Air Ground Engagement Model determines all attrition and casualty results of such interactions. The Air Ground Engagement Model is sufficiently flexible that major changes in aircraft characteristics, quantity or mixes of the major weapon systems, or their modes of employment will be reflected in the measures of force effectiveness. Single or multiple aircraft flights are generated by the Intelligence and Control Model or are directed by gamer orders. Attrition of aircraft while in flight is based on the location of air defense capable units; i.e., units that contain air defense weapons. The Air Ground Engagement Model divides the flight path into the following segments as appropriate: air base to safe point, safe point to target, target to safe point, and safe point to air base. The Air Ground Engagement Model:

- Selects from available aircraft and munitions types those best suited for the mission, determines the time required for aircraft preparation and pilot briefing, and schedules the time for aircraft to be airborne.
- Maintains a current status record for aircraft assigned to a mission, to include munitions and POL, aircraft losses caused by enemy activity, and effects of the aircraft on enemy targets.
- Moves the aircraft progressively along the mission segments, assessing aircraft status,[6] attrition, and accomplishments at the completion of each segment to determine if the mission should continue.
- Determines the results of attacks on targets in terms of aircraft losses and target losses.
- Upon completion of the mission and return to the airbase, aggregates total mission results (including total mission time), assesses aircraft damage, and determines delay times for subsequent mission availability of the aircraft.

5. Suppression Model. The treatment of suppressive effects of area fires or aerial strikes upon a unit was introduced to the DIVWAG Model through the addition of a Suppression Model. This model represents

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6. Includes effects of air defense activities, weather, and terrain.

suppressive effects by the interruption of selected activities (unit movement, delivery of area fires, delivery of air defense fires) in response to incoming fire. Length of interruption depends on the activity interrupted and nature of fire received, and the interruption is extended as fires continue to be received.

(c) Movement Model. The Movement Model represents unit movement other than airmobile operations including the effects of those activities that serve to improve or impede movement. The Movement Model provides the quantitative data necessary for evaluation of force effectiveness as a function of ground movements, and the related effects of significant changes in the mixes and types of mobility means. The Movement Model considers the following aspects of force mobility:

1. Air Movement. The Air Movement section of the model simulates moves by aircraft not in connection with airmobile operations. Air movements may be ordered externally by gamers or generated internally by the Air Ground Engagement Model. Aircraft availability, Class IIIA supplies, and weather limitations are checked before the air movement is allowed. Air routes altitudes, and speeds are specified by the gamer order or are determined by the model generating the movement internally. Once the air movement is initiated, it will be completed unless terminated due to losses. At the end of each flight segment the unit will be updated to reflect losses of aircraft and personnel and the status of associated supplies.

2. Ground Movement. The Ground Movement section of the model simulates moves by surface transportation. Ground movements of units not engaged in combat are ordered by gamers. Ground movements are affected by category of move, unit mission, formation type, vehicle mobility characteristics, terrain conditions, daylight or darkness, road nets, weather, natural obstacles, and enemy created conditions. The maximum movement rate for a unit is the rate of the slowest type vehicle in the unit. Some of the other characteristics of ground movement are indicated below.

a. Administrative/Supply Movements. Administrative routes are generated by gamer orders; supply routes, by the Combat Service Support Model. The road movement rate depends on road type, grade, weather conditions, and nighttime or daytime conditions. Administrative movements are executed in segments determined by terrain cell boundaries or en route obstacles. Units are halted by events scheduled for the moving unit and by encountering obstacles. After the delay, the unit is not able to make up this lost time but continues to move at its appropriate rate.

b. Tactical Movements. Tactical routes are generated by gamer orders and are executed in segments in the same manner as administrative movements. Starting times and normal tactical movement rates are specified for each unit type for attack, withdrawal, and reinforcing missions, as well as for day or night movements. Units are halted for obstacles or minefields. After such delay, tactical units attempt to make up the lost time, and move

at the limiting mobility class rate for that purpose. The limiting mobility class rate depends on terrain roughness and vegetation, slope and soil trafficability, forestation, weather conditions, and nighttime or daytime conditions. Each equipment type is assigned to a mobility class, and only those mobility classes used during tactical movements are considered for determining the limiting mobility class.

c. Maneuver Movements. Maneuvering weapon systems execute their movements at maximum limiting mobility class rates. Since different weapon systems have different maximum rates, and since the movement rate of a maneuvering unit is limited by the rate of the slowest weapon system, faster weapon systems have periods of time when they are stationary. Maneuver movement is controlled entirely by the Ground Combat Model, which determines detection capabilities, vulnerability, and weapon system capabilities.

3. Stay Activity. The model also simulates stationary activities for all gamed units not engaged in other specified activities; i.e., all units that are not performing another military activity such as firing, moving, or combat. Whether or not addressed by gamer orders, an inactive game unit will consume Classes I and III supplies and can be assessed as to losses and status; other units can gain information about the inactive unit. If a unit has completed all its orders before the end of a game period, the unit will automatically stay until the end of the period. Stay activity orders can be written to command ground units to remain in position for a specified length of time or until a specified game time arrives.

4. Engineer. The Engineer Model simulates the scheduling and execution of engineer activities associated with the construction and destruction of obstacles and facilities. The model accepts engineer tasks, assigns task priorities, determines task feasibility, mobilizes mission units to execute the tasks, simulates the engineering activity in terms of time and material resources used, and demobilizes the mission units.

a. Obstacles and facilities are parts of an overall barrier plan developed for the game being conducted. Engineering activities can be initiated by gamer order to start work on a specified obstacle or facility or by request from the Movement Model when some engineering activity is necessary for the conduct of a directed movement. Where the engineer activity is requested by the Movement Model, the moving unit is unable to complete its move until the engineer activity is completed.

b. Engineer task priorities are based primarily upon the urgency of the activity in terms of its impact on the force's overall plan of maneuver. Task feasibility is determined in terms of task site (proximity to FEBA) and time and materiel availability.

c. The Engineer Model automatically allocates resources to each feasible task, constructs a mission unit to execute the task, moves the mission unit to the task site, simulates the initiation of work when

sufficient resources are on site, periodically updates task status until completion of the task (or until a gamer order to stop the task is encountered) and returns the mission unit to its origin.

(d) Airmobile Model. The Airmobile Model permits simulation of a variety of airmobile operations. To maintain a high degree of flexibility in application of the model, the simulation depends upon the gaming staff for most of the general planning and decision making prior to execution of an airmobile operation. These plans are relayed to the model by a set of DSL orders. Activities actually simulated within the model include allocation of transport and escort aircraft to conduct the operation, staging and loading of the airmobile force, the actual airmobile movement, attrition of the airmobile column while in flight to and from the objective area, suppression of air defenses by escort aircraft, deplaning at a landing zone, refueling and rearming of aircraft, and the release of aircraft from operational control of the airmobile force.

(e) Combat Service Support Model. This model simulates the resupply of manpower and materiel to units within the DIVWAG system. The model deals with personnel replacements, replacement of major items of equipment, and resupply of critical consumables such as food (Class I), fuel (Class III and IIIA), barrier materials (Class IV), and ammunition (Class V).

1. Replacement of personnel and major items is accomplished once for each simulated day of combat. Availability of replacement personnel and major end items is on a daily basis, input by the gamer, with available assets accumulating over time; i.e., assets not used on previous days are available in addition to those available for the current time. Requirements are based on unit losses, represented by the authorized unit level of personnel and major items less the quantities on hand within the unit at the time of the replacement action. First priority for replacements and major end items is to front line maneuver units, second priority to reserve maneuver battalions and all artillery units, and third priority to all other units. If sufficient replacements or major end items are not available to fill the needs within a unit priority group, each unit receives a pro rata share of available resources based on amounts required by all units within the priority group. Replacements and major end items arrive at the receiving units after an appropriate travel delay.

2. The treatment of resupply of consumables within the Combat Service Support Model is conceptually similar to treatment of replacement of personnel and major items. Implementation differs to account for the following:

a. No limitation is placed on quantities of consumables available to the force. In the case of consumables, the primary limiting factor is the availability of transportation to move the materiel from various supply points to the consumer. The model treats movement of consumables through a series of supply points from the nominal point of entry into the force to the using unit. The model uses either a unit distribution or a supply

point distribution method on each leg of the supply chain, depending upon the supply class of the consumable and the nature of the receiving unit at each node.

b. To accomplish a more continual flow of consumables, resupply requirements are determined and actions initiated on a more frequent basis than with replacements. The model currently uses a 2-hour cycle for all consumables except Class I, which is on a once-a-day cycle. (As experience is gained with the model, some appropriate cycle between the extremes of hourly and daily requirement determination should be established.)

c. A request for resupply of consumables is generated if the quantity in the unit trains is less than a fixed percentage of the authorized amount in trains. That percentage is currently set at fifty percent.

CHAPTER 2

GAME OPERATIONS

1. PURPOSE. The purpose of this chapter is to describe the management, planning, and operations necessary to conduct a force analysis using the Division War Game (DIVWAG) Model.

2. GAME DIRECTIVE. The preparation of a Game Directive by a sponsoring agency requesting the use of the DIVWAG Model in support of a force analysis study is a critical element in the initial preparation for task execution.

a. The game sponsor must ensure that he communicates, through the Game Directive, the intent and purpose of the force analysis study and the nature of the expected results. The game and analysis objectives must be clearly and succinctly stated in the Game Directive provided by the sponsoring agency. The number and complexity of game and analysis objectives bear a direct relationship to the study's chances of success. Lt. Gen. Julian J. Ewell (then Major General and Deputy Commanding General, U.S. Army Combat Developments Command) wrote:

> If a major study directive asks ten or fifteen major questions, its chances of a successful ending are heavily compromised before it gets underway. Every effort should be made to narrow a study down to one major question, with four probably the absolute maximum for a reasonable effort and result. The narrowing can only take place after considerable thought as there are usually many (apparently) logical alternatives or options. However, after much screening effort, the supercilious, redundant, inconsistent, or secondary questions can be determined and either eliminated or placed in a category to be answered only if time permits.... Another facet of the same problem is the habit of mixing large and small issues in a directive. This makes a study most difficult. A big issue usually requires a "big grain" study approach, a small issue a "small grain" approach. Mixing them may require two studies in effect or a rather feeble cut at the less important one.[1]

b. The responsibility for the success or failure of a study (and the attendant credit or discredit) rests ultimately with the sponsoring agency; thus, the sponsor is vitally interested in conducting a scientifically and militarily valid study and in obtaining wide acceptance of study results. Task objectives that are too numerous or complex to be addressed within study resources or that do not adequately reflect the intended purpose of the

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1. Letter, CDCDG to Chief of Staff, USACDC, dated 12 February 1968, Subject: Informal Thoughts on Study Management at the USACDC Level.

analysis can only lead to unsatisfactory results. Game managers can help to avoid this outcome and to achieve a mutually beneficial end by thoroughly coordinating their analysis of game objectives with the study sponsor and by suggesting redefinition or reorientation of objectives when appropriate; however, the game sponsor cannot abdicate his responsibility to pose the study problem within realistic parameters and to establish game objectives that fairly define that problem.

c. The Game Directive as a minimum must contain the following information:

- Purpose and objectives of the game
- Forces to be played
- Environment
- Force missions to include scenarios and operation orders
- Guidance such as:
  - type of game (open or closed)
  - period of game
  - data base to be used
  - assumptions to guide the game/analysis
  - guidelines for play of the game
  - doctrine
- Results required
- Administration

An example of a Game Directive containing the information described above is at Appendix B, Game Directive for WAGCAP Test Game, Volume VII, WAGCAP Testing Report.

3. GAME CONCEPT:

a. The ability of management to understand the problem to be solved, to design a methodology for its solution, and to develop a plan for the timely and efficient execution of the methodology is fundamental to the success of any force analysis.

(1) The problem to be solved must be analyzed in terms of the objectives or purposes of the entire effort, anticipated use of the study results, and the resources available for application to the study.

(2) Once the study problem is understood and clearly defined, an appropriate and efficient methodology for its solution must be selected or designed. The methodology must be appropriate in terms of providing useful answers or insights to the study problem and efficient in terms of making the best possible use of resources within the constraints of the study.

(3) After the problem and methodology are well defined, the development and application of a management plan become of paramount importance. The plan must provide for efficient use of personnel resources, must consider calendar time constraints, and must ensure that the study effort maintains its direction and that the results are integrated to fulfill study objectives.

b. The application of the Division War Game Model to an analytical task consists of three distinct phases:

- Initial preparation for task execution
- Production of evaluation data
- Application of analytical methodologies.

Figure 2-1 presents the time sequence of these three phases, each of which is discussed in following paragraphs.

4. INITIAL PREPARATION FOR TASK EXECUTION. The receipt of a Game Directive from the sponsoring agency initiates preparation for task execution. During this phase, effort must be directed at several facets, including:

- Development of the Game Plan
- Development of the Analysis Plan
- Collection and loading of the constant input data.

a. Development of a Game Plan. The conduct of a war game using the DIVWAG Model must be preceded by a detailed analysis of the factors that are critical to game operations and the subsequent development of a Game Plan.

(1) Analysis of Game Objectives. The analysis of game objectives must include an appreciation of the intended use of the analysis results. By remaining aware of the potential applications of study results through all phases of study performance, management can help to ensure that the final product of the analysis meets the sponsor's needs.

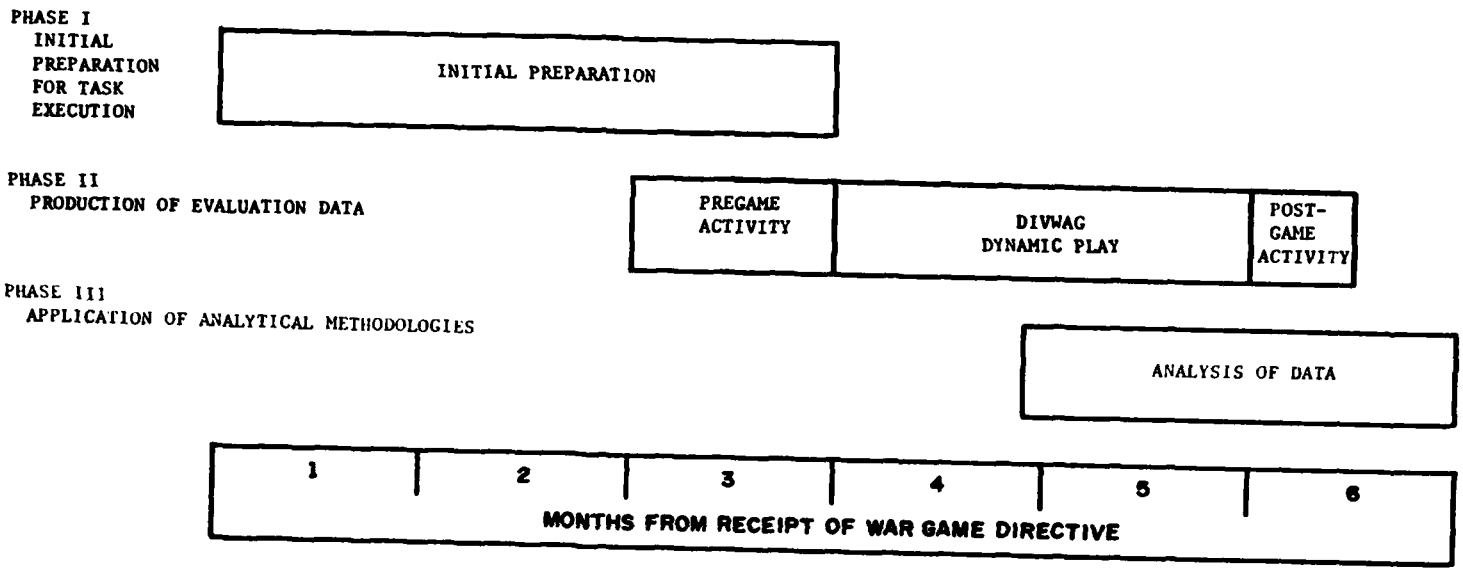

Figure 2-1. Time Sequence of Force Analysis Using DIVWAG

(2) Design of a Methodology. The selection of a methodology by which the objectives will be fulfilled is one of the most crucial elements in a division force analysis. The methodology must be appropriate to the problem, able to be performed within task resources, and capable of fulfilling task objectives. The steps include:

(a) Selection of Measures of Effectiveness and Effectiveness Indicators:

1. The primary measures of effectiveness (MOEs), or the criteria upon which the forces will be evaluated, should be apparent from the analysis of task objectives. A faulty selection of the primary MOEs reflects an incomplete understanding of the objectives and can seriously degrade study acceptability since the primary MOEs provide the basis for the entire evaluation. On the other hand, the secondary MOEs and effectiveness indicators supporting the primary MOEs must be chosen from a wide range of possibilities; their selection entails value judgments as well as a careful analysis of the components of the primary MOEs.

2. Chapter 2 of Analytical Methodologies[1] contains a detailed discussion of the selection of an MOE hierarchy to support a division force analysis. The primary MOE is designated as mission accomplishment, and secondary MOEs are designated for each of the functional areas of land combat. Effectiveness indicators supporting each secondary MOE are chosen on the basis of quantifiable data considered pertinent to the analysis of force effectiveness in each functional area represented by the secondary MOE.

3. Management must emphasize the importance of the MOE hierarchy as the basis for the analysis methodology. Its selection requires careful and thorough study by analysts familiar with the forces to be evaluated, the doctrine and tactics to be employed, and the evaluation objectives. The MOEs and effectiveness indicators selected must be coordinated with the sponsor and his review board to ensure that they adequately reflect the desired study emphasis.

(b) Definition of Performance Data Requirements. The definition of performance data requirements is an outgrowth of the selection of MOEs and effectiveness indicators. The data necessary to quantify the MOEs and effectiveness indicators for all units or systems of interest under a prescribed range or combination of conditions constitute the performance data required for the analysis. Management depends upon the game sponsor to provide the parameters for the evaluation through a scenario and other guidance; staff analysts then determine performance data needed to conduct the complete evaluation based on the MOEs and effectiveness indicators and produce the Analysis Plan to accomplish the evaluation.

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1. Development of a Division War Game Model (DIVWAG), Analytical Methodologies (Volume II), USACDC Combat Systems Group study, December 1971.

(3) Analysis of Critical Game Factors. Within the framework of resource constraints imposed by the Game Directive, management then identifies and conducts an analysis of critical game factors. Critical factors will vary from game to game, but they typically include:

(a) Game Requirements. Game requirements include the number of games to be played, the number of game days to be played, and the specific type engagements required.

(b) Game Content. Game content refers to such elements as the forces to be gamed, the level of resolution and degree of aggregation, organizational and equipment considerations, and battle termination criteria.

(c) Staff Requirements. A representative listing of the skills required by a war game includes the following:

1. Management:
   - Game director
   - Deputy director/technical advisor (operations research)
2. Technical:
   - Military analyst
   - Operations research analyst
   - Systems analyst
   - Computer programmer
   - Editor
   - Technical assistant
3. Support:
   - Administrator
   - Keypunch operator
   - Clerk/typist
   - Document control clerk
   - Graphic arts technician.

The number of assigned individuals in each skill category will vary from game to game. For some games, two or more skills may be provided by one individual (e.g., an operations research analyst may double as a computer programmer).

For other games, several individuals of similar skills will be needed to perform a particular function.

(d) Model Operation. This factor includes the characteristics of the models to be used, consideration of use of component submodels in a simulation mode, and man/machine interfaces.

(e) Time Constraints. The analysis of critical time constraints will consider the size of the force to be gamed, the number of game days to be played, calendar time allocated, computer running time to game time ratio, game period turnaround time, manning levels and skills available, and analysis requirements.

(f) Game Operation. The war game is conducted after due consideration of the impacts of all other critical factors and results generally in the cycle scheduling required for the timely completion of dynamic game, analysis, and documentation effort.

b. Preparation of the Game Plan. After completion of the analysis described above, management prepares a Game Plan to guide the staff effort through the conduct of the game. The Game Plan should, if at all practicable, be coordinated with the game sponsor to ensure that the game will be conducted in a manner which will produce the results desired by the sponsor. Figure 2-2 is an outline for a typical Game Plan. It shows major paragraph headings and gives a brief description of the type information to be included under each heading. The Game Plan consists of three basic sections--Game Setting; Methodology, Rules, and Procedures; and Staff Organization--which are discussed in the following subparagraphs.

(1) Game Setting. This section of the Game Plan provides the staff with all essential information concerning the game objectives, the scenario, the general and special situations, and general guidance regarding collection of data. It may include administrative information, such as security procedures and a reference list.

(2) Methodology, Rules, and Procedures. The general methodology and the interface with the analytical effort described in the Analysis Plan is documented. Rules are fixed constraints that determine the nature of inputs to the game, the handling of these inputs with the gaming model, and the resultant outputs of the model. Game rules and procedures play a vital role in the conduct of a war game. They are acquired from the Game Directive, the Game Plan, the model (in this case the DIVWAG Model), and from the Chief Controller as a result of his responsibility to ensure that the game is controlled in an orderly process to ensure achievement of game objectives. Rules may be of two types, game rules and technical rules. A thorough understanding of the rules inherent to the conduct of any specific game is essential to a valid interpretation of the results of that game.

GAME PLAN

Section I. GAME SETTING

1. PURPOSE

A statement that the game plan is the basic document providing policy, procedural, organizational, and administrative guidance for the conduct of all game phases.

2. STATEMENT OF THE PROBLEM

A concise statement of the job to be performed.

3. GAME OBJECTIVES

A statement of the specific game objectives as interpreted from the game directive issued by the sponsoring activity.

4. SCENARIO

A description of the conflict situation to be gamed.

5. GENERAL SITUATION

A description of the geographical and political environment for the conflict to be gamed.

6. SPECIAL SITUATIONS

A special situation description for each force to be gamed (Red and Blue) and the disposition and missions of each force. Contains privileged information and is issued only to the appropriate player team and the control team.

7. REFERENCES

A listing of documents to be used in data base preparation and as doctrinal guidance for the Red and Blue forces to be evaluated.

8. SECURITY

Standard operating procedures for handling classified defense information, privileged information within the game, and visitors and physical security at the war game facility.

Figure 2-2. Sample Game Plan Outline (continued next page)

Section II. METHODOLOGY, RULES, AND PROCEDURES

9. METHODOLOGY

Describes the general methodology and interface with the analytical effort described in the Analysis Plan.

10. RULES

a. Doctrinal

Describes rules on doctrine. Particularly pertinent when new and untested concepts, force structures, and equipments are gamed.

b. Operational

Describes rules derived from concepts and doctrine. Impacts particularly on comparability in a project requiring comparison of forces in different games.

c. Technical

Rules reflecting model-dependent considerations.

11. PROCEDURES

a. Game Cycle

Procedures to be applied in conducting an entire game cycle (as distinguished from a computer cycle). Defines game cycle in terms of beginning and ending point and explains schedule for completion of a normal cycle. Particularly important in keeping project on programmed calendar schedule.

b. Gaming Rate

Provides schedule of game cycles in terms of physical effort of game turnaround and average game time per cycle.

c. Levels of Resolution/Aggregation

Prescribes levels of resolution and aggregation for mainstream game. Also for side analyses and sensitivity tests, if requirements have been identified.

Figure 2-2. Sample Game Plan Outline (continued)

d. Side Analyses/Sensitivity Tests

Procedures for side analyses and sensitivity tests, if such requirements are identified pregame.

e. Critical Events

Any military phenomenon of the battlefield the occurrence of which results in a decided advantage for one of the protagonists. Explains requirements to game such events arising from game directive or from deduction resulting from preliminary force analysis.

f. Personnel Schedules and Roles

Describes any peculiar scheduling or personnel requirements, such as an irregular work schedule for a particular period because of computer hour allocation.

g. Computer Interface

Establishes procedures for assembly of game cycle turnaround data into machine readable format and prescribes gaming element responsible for assembly, delivery to and pickup from the computer, and the associated records of the entire process.

h. Records Requirements

Listing of all game records to be maintained and the responsible element.

i. Quality Assurance

Identifies responsible game elements and responsible individuals by position title.

Section III. STAFF ORGANIZATION AND OPERATION

Gives staff organization and associates individual staff members with position titles; may include detailed job descriptions and instructions.

Figure 2-2. Sample Game Plan Outline (concluded)

(a) Game rules are:

1. Rules derived from concepts and doctrine for the employment of forces and systems being gamed (doctrinal rules).

2. Rules for the conduct of military operations during the game, or for making decisions concerning such operations (operational rules).

(b) Technical rules are:

1. DSL rules which relate to the use of the basic DIVWAG Scenario Language (DSL).

2. Model rules which pertain to variables within the computer programs that cannot be adjusted without modification to the program.

(c) Procedures are those administrative controls employed to ensure an orderly sequence of events in gaming processes and to extract maximum efficiency from the available resources.

(3) Staff Organization and Operation. This section of the Game Plan describes the organization of the staff for the game. It should be sufficiently flexible to allow added detailed descriptions of the tasks of individual members of each group. Detailed staff roles and functions are described in Paragraph 5a(4), below. An example of a Game Plan is at Appendix C, Game Plan for WAGCAP Test Game, to Volume VII, DIVWAG Testing Report.

c. Development of an Analysis Plan:

(1) A sound plan for analyzing the performance data produced by the war game model is essential to the successful completion of the study. A haphazard, poorly-planned, or hurried analysis can, at worst, discredit a study or, at best, give rise to charges that the analysis has failed to exploit fully the potential of the war game output.

(2) A plan for analysis of output data should provide for the performance of both subjective and quantitative analysis and the integration of results into a product responsive to task objectives. Chapters 2 and 3 of Analytical Methodologies[2] describes a methodology for analyzing force performance data to evaluate a single force and to compare alternative forces. This methodology employs subjective judgment and statistical techniques to derive and test inferences regarding force performance under a variety of background conditions. Appendix D, Analysis Output Processor Users Guide, to this volume provides instructions for the automated data extractor for the DIVWAG Model.

(3) Management should ensure that an analysis plan is developed and approved well in advance of the initiation of game play. Analysis of data can then be performed according to the plan concurrently with play of the game.

2. Ibid.

In this way, analysts can monitor the adequacy of game output for analysis purposes and can identify requirements for side analysis.

(4) The Analysis Plan has no specified format but should contain the following elements as a minimum:

- Purpose
- Scope
- Objectives
- Assumptions
- Guidelines
- Performance data requirements to include measures of effectiveness and effectiveness indicators
- Analysis procedures
- Documentation requirements
- Administration
- References

An example Analysis Plan incorporating all of the above elements is at Appendix D, Analysis Plan for WAGCAP Test Game, to Volume VII, DIVWAG Testing Report.

d. Collection and Loading of Input Data:

(1) The conduct of a war game using DIVWAG requires the utilization of a large data base containing many thousands of data items. These data must be derived or extracted from available sources, coded, and entered into storage devices. Volume II, Analyst/Programmer Manual, provides a description of the data required as input by DIVWAG prior to the conduct of a game to produce data for evaluation, and detailed instructions for entering the data onto standardized card formats compatible with the programs that will actually load the data from cards into the constant data files. The collection of information and its loading as the constant data for the DIVWAG Model are critical and time-consuming steps in task preparation. The accumulation of the constant data requires ten steps:

(a) Identifying input data requirements for all submodels.

(b) Identifying data sources.

(c) Obtaining sponsor approval of data sources.

(d) Obtaining documentation from the data sources.

(e) Extracting pertinent data and verifying that the data are appropriate for their intended use in the particular submodel or file within DIVWAG.

(f) Preparing data input forms (coding of data onto standardized card forms).

(g) Keypunching of input data cards.

(h) Loading of input data cards into the proper files within the computer.

(i) Verifying that the data stored in the constant data input files accurately represent the data transcribed from the documentation sources and that they are in consonance with the sponsor's overall guidance.

(j) Documenting the data base as a portion of the war game report.

(2) Management should be aware that each of these steps is time-consuming and that difficulties can arise, especially when data must be obtained for new or conceptual units or systems, and should ensure that the data are gathered in accordance with a plan and a stringent schedule. A potential for human error exists at several points in the data preparation process, and management should establish a system of checks and approvals to minimize the chances of a damaging data input error. Acceptance of the final analysis product can be jeopardized by unacceptable input data. For this reason management cannot overemphasize the importance of the data collection process and its thorough coordination with the sponsoring agency.

e. Summary. The initial preparation for a division force analysis is a critical managerial assignment. The game manager must understand the significance of the problem and determine the nature of the end product required to fulfill task objectives. He must ensure that the methodology designed for the task is complete, capable of being performed within task resources, and responsive to task requirements. He must supervise the development of a plan for analysis of data and must assemble and organize a staff representing the requisite skills for successful performance of the entire study. Satisfactory completion of the study rests obviously with thorough management planning and timely accomplishment of tasks during the preparation phase.

5. PRODUCTION OF EVALUATION DATA. The second phase of a division force analysis consists of three activities; i.e., pregame activities, dynamic game play, and postgame activities. The following subparagraphs describe the pregame and postgame activities. Chapter 3 discusses the dynamic game play.

a. Pregame Activities. The pregame activity period is a vital part of the entire model application process. Activities conducted during this period include:

- Establishment of control procedures
- Acquisition of facilities, visual aids, supplies, and equipment
- Revision of DIVWAG Model/data base
- Organization of the staff for game operations
- Preparation for the first game period.

(1) Establishment of control procedures for defense information as well as for game information is an essential pregame activity. Defense information security must adhere to the appropriate industrial or governmental security regulations. In addition to government security handling procedures, game information may have to be distributed on a game need-to-know basis. Control procedures must be established for game records. Vital analysis records must be identified, and appropriate systems and procedures must be set up to maintain the quality and integrity of these records. In addition, administrative records are required to assist in maintaining schedules and recording operational shortfalls so that improved game operational procedures can be developed.

(2) Acquisition of facilities, visual aids, supplies, and equipment must precede any serious attempt to apply the DIVWAG Model. Working space is required for player and control teams, support personnel, analysts, and computer model maintenance personnel. A graphic support facility, reproduction equipment, visual aids, and an appropriate stock of expendables must be provided to support the game.

(3) In many cases, the DIVWAG Model will require some modifications to make explicit a representation of combat that may have been treated implicitly before. If this is not required, the mere fact that a game is ordered means that previous games did not adequately address the problem; thus, the data base will undoubtedly need revision. These steps must be undertaken as early as possible.

(4) The gaming staff (depicted in Figure 1-4, Chapter 1, and delineated in the Game Plan) should be organized for dynamic game play during pregame activity. The functions and responsibilities of each participant in the game should be clearly defined. General functional responsibilities are described below.

(a) Game Director. The Game Director directs and supervises all aspects of the war game operations. His responsibilities include:

1. Interpreting the Game Directive and translating it into a Game Plan.

2. Interpreting current military doctrine and the proposed doctrine being tested.

3. Establishing operational and control policies for gaming operations within the constraints of policies provided by the Game Directive.

4. Functioning in the hierarchy of military units as the commander of the military unit next superior to the highest military unit being gamed. For example, if the highest military unit being gamed is a division, he will function in the role of corps commander and will provide corps operation orders and intelligence situation reports if required.

(b) Deputy Director/Technical Advisor. The Deputy Director/ Technical Advisor provides technical expertise for war game operations. His responsibilities include:

1. Providing to the Game Director and all organizational elements of the gaming staff, technical advice and assistance on the operational aspects of the war game model.

2. Maintaining close liaison with the Analysis Team to assure that data being produced are adequate for evaluations performed by that group.

3. Coordinating the arrangements for, and making recommendations regarding, side analyses and sensitivity tests identified by the Analysis Team as requirements.

4. Monitoring of gaming operations and procedures to ensure that they are in consonance with the Game Directive and related directives.

(c) Chief Controller. The Chief Controller directs, supervises, and participates in the military play as required to provide effective gaming operations. His responsibilities include:

1. Translating the Game Plan into a Game Period Concept for each game period.

2. Enforcing current military doctrine and proposed doctrine being tested.

3. Conducting controller briefings of the Game Director, other controllers, and the player teams.

4. Directing and participating in the preparation of battle orders.

5. Coordinating the preparation of unit scenarios.

6. Assembling and checking the DSL card deck.

7. Conducting error analysis of the Control Team portion of the military aspects of the data processing.

8. Interpreting overall game period results and their acceptability.

9. Operating the Control Team game room and maintaining related displays.

10. Preparing and maintaining game records adequate to provide a sound basis for evaluation of game results.

11. Directing and supervising the preparation of game period reports.

(d) Blue Controller. The Blue Controller provides staff support to the Chief Controller and assists him in handling functions related to Blue Team gaming operations. His responsibilities include:

1. Coordinating control matters affecting the Blue Team.

2. Advising the Chief, Blue Team, on operational matters.

3. Assisting in the preparation of the Game Period Concept.

4. Assisting in the preparation of controller briefings.

5. Assisting in the preparation of battle orders.

6. Preparing post-battle instructions for Blue units.

7. Assisting in the coordination of Blue unit scenario preparation.

8. Assisting in the assembly and checking of the DSL card deck.

9. Assisting in the error analysis of the Control Team portion of the military aspects of the data processing.

10. Assisting in the interpretation of game period results.

11. Assisting in the operation and maintenance of the Control Team game room and related displays.

12. Assisting in the maintenance of gaming records.

13. Assisting in the preparation of gaming reports.

(e) Red Controller. The Red Controller provides staff support to the Chief Controller and assists him in handling functions related to Red Team gaming operations. His responsibilities are identical to those of the Blue Controller.

(f) Technical Assistant. The Technical Assistant assists the Control Group in executing operational functions of a routine nature. His responsibilities include:

1. Assisting in the operation and maintenance of the Control Team game room and related displays.

2. Assisting in the maintenance of gaming records by functioning as records controller for the gaming staff.

3. Assisting in the preparation of gaming reports.

(g) Records Clerk/Messenger. The Records Clerk/Messenger performs administrative duties for the Gaming Staff. His responsibilities include:

1. Typing and reproducing documents as required.

2. Assisting in the preparation of gaming reports.

3. Assisting the Control Team Programmer in the processing of operational card decks.

4. As a messenger, transporting card decks, work requests, and printouts between the War Game and the DPFO.

5. Performing other duties as assigned.

(h) Control Team Programmer. The Control Team Programmer processes operational card decks into and out of the War Game Facility and the DPFO and stores and maintains operational decks as required at the War Game Facility during a game. His responsibilities include:

1. Receiving DSL card decks from the gaming staff.

2. Inserting appropriate processing control cards into the card decks.

3. Preparing processing request forms.

4. Logging card decks into and out of the War Game Facility.

5. Arranging messenger service and dispatching card decks from the War Game Facility to the DPFO.

6. Arranging messenger service and pickup of card decks and printouts from the DPFO and delivery to the War Game Facility.

7. Receiving card decks and printouts at the War Game Facility.

8. Removing processing control cards from the card deck.

9. Delivering printout to the gaming staff.

10. Segregating and storing operational decks at the War Game Facility as required.

(i) Blue/Red Player Teams. The Blue/Red Player Teams play the real world role of commander and staff of the highest military unit being gamed; i.e., the team directs the military play of that unit in consonance with the Game Period Concept, current force military doctrine, and proposed military doctrine being tested.

1. Team Chief. The Team Chief directs, supervises, and participates in the military play of Blue units as required to provide an effective Blue force contribution to gaming operations. His responsibilities include:

a. Translating the team portion of the Game Period Concept into a Commander's Concept and Operation Order.

b. Conducting team briefings to the Control Team.

c. Directing and participating in unit scenario preparation.

d. Conducting error analysis of the force portion of the military aspects of the data processing.

e. Interpreting the force portion of the game period results and their acceptability from the team standpoint.

f. Operating and maintaining the team game room and related displays.

g. Preparing and submitting team gaming records adequate to provide a sound basis for evaluation of gaming results.

h. Directing and supervising force inputs to gaming reports.

2. Gamer. The Gamer provides staff support to the Team Chief and assists him in handling functions related to gaming operations. His responsibilities include:

a. Preparing staff estimates.

b. Assisting in the preparation of Operation Orders.

c. Assisting in the preparation of team briefings.

d. Preparing unit scenarios.

e. Assisting in the error analysis of the force portion of the military aspects of the data processing.

f. Assisting in the interpretation of the game period results and their acceptability from the team standpoint.

g. Assisting in the operation and maintenance of the team game room and related displays.

h. Preparing team gaming records.

i. Preparing force inputs to gaming reports.

(j) Model Maintenance Team. The Model Maintenance Team operates, maintains, and modifies the DIVWAG Model as required to permit effective dynamic gaming.

1. Chief Analyst. The Chief Analyst directs, supervises, and participates in Model Maintenance Team activities as required to support effective gaming operations. His responsibilities include:

a. Modifying the DIVWAG Model as required to meet specific requirements of the Game Directive and Game Plan.

b. Maintaining and updating technical manuals and programming manuals related to the DIVWAG Model.

c. Conducting technical error analysis of DIVWAG operational ADP outputs.

d. Trouble-shooting and correcting technical problems involved when the DIVWAG Model does not perform as expected.

e. Designing and preparing control decks and deck assembly instructions for processing input data through the DPFO.

2. System Analysts. The System Analysts assist the Chief Analyst in those activities necessary for carrying out his functions and responsibilities.

(k) Analysis Team. The Analysis Team analyzes game objectives, determines data requirements for satisfying the objectives, analyzes gaming results to determine that data being produced are in consonance with those data requirements, and evaluates gaming results in terms of game objectives. The Analysis Team consists of Operations Research Analysts and System Analysts specializing in analytical evaluation methodology.

(5) After the staff is organized, the model and data base revised, facilities acquired, and control procedures established, the final step in the pregame activities is preparing for the first game period.

(a) The following actions must be taken:

1. The Game Director will brief the staff on the objectives outlined in the Game and Analysis Plans and present his plan and concept for the conduct of dynamic game play.

2. The Control Team will prepare the Game Period Concepts in accordance with guidance in the Game Plan, and the Chief Controller will brief the Game Period Concept to the Game Director.

3. The Control Team will brief the Player Teams on the concept for the first period, and the Player Teams will prepare their Operation Plan and Concepts. To reduce the number of briefings, the Player Teams may attend the Control Team briefing to the Director.

4. The Player Team Chiefs will brief the Control Team on their concepts and plans for the first period.

5. The Player Teams will prepare their unit scenario input for the first period.

6. The Control Team will prepare the battle orders and integrate the team unit scenarios into the DSL deck.

7. The Model Maintenance Team will initialize the DIVWAG system by running a "ZERO" period.

8. The Control Team will prepare Operating Instructions for the first game period.

9. The Operating Instructions and DSL Edit will be processed through the DPFO.

10. Errors, if any, in the DSL deck will be corrected, and a DSL compile will be processed through the ADP Facility.

11. The first game period will be processed through the ADP facility.

(b) The procedures and techniques associated with the sequence described above are explained in Chapter 3 to this volume. The running of the first game period signals the beginning of dynamic game play, the subject of Chapter 3.

b. Postgame Activities. When the required evaluation data have been accumulated from the dynamic play phase, the War Game Facility is placed on an inactive status. At this time, many of the control procedures can be lifted. Postgame activities include completing records, providing indexes to data tapes and output listings, and other administrative steps. The gaming staff is often asked to record their insights for use in the evaluation of the force played. Specific activities for the gaming staff during this step are:

(1) Securing and indexing all records.

(2) Preparing final report of gaming, including recommendations for model improvements and game operation and procedures improvements.

(3) Assisting with analysis of game data in accordance with the Analysis Plan.

6. APPLICATION OF THE ANALYSIS METHODOLOGY. The third phase of the division force analysis, application of the analysis methodology, can begin as soon as evaluation data are available from the game. The Analysis Team augmented by the gaming staff applies the procedures established by the Analysis Plan to evaluate performance data by both subjective and statistical techniques. The results are documented, interpreted, and presented to the sponsor in terms of the original game objectives. Management concern during this final phase of the study effort is directed toward:

- Successful accomplishment of the Analysis Plan, especially the integration of the subjective and statistical analysis aspects
- Cogent presentation of the analysis results as fulfillment of the study objectives
- Final achievement of a sound basis for acceptability of results.

a. Performance of the Analysis Plan:

(1) The purpose of the Analysis Plan is to ensure that the analysis produces the information required by the game objectives. A research war game is played to obtain the answers to difficult questions. These questions may

be very specific or very general. As an example, a specific question might concern the improvement in force performance effected by a single weapon system, and a general question might require a "yes" or "no" answer to whether Force One is better than Force Two. The Analysis Plan ensures that the correct data are analyzed in a form adequate to answer the questions posed by the game objectives.

(2) While dynamic game play is in progress, evaluation analysts can determine from game period results the areas where game-generated data are inadequate for satisfying evaluation requirements. These inadequacies are brought to the attention of the Game Director, who evaluates them and who may then issue game-modifying instructions as appropriate. In some cases, the Chief Controller, working within the constraints of existing gaming rules, may be able to manipulate game events or procedures in a manner that will produce the required data without modifying the game rules.

(3) A war game produces an overwhelming mass of data ranging from the subjective impressions of the staff operating the game to the straight reporting of consumption and loss figures. In satisfying the game objectives, all data, subjective and objective, must be integrated and synthesized in a manner permitting comprehension. Subjective impressions of force performance are combined with objective reporting of facts to provide credible answers to the study objectives.

b. Presentation of Analysis Results. A war game has been characterized as a communication system in which participants with different reference frames are required to comprehend each other. In the presentation of analysis results this concept must be extended to include the game sponsor; he is a node in the communication system. Whatever information is obtained from the analysis must be communicated with near perfect comprehension. In most cases the game sponsor does not participate in the game. He is, therefore, denied the advantage of an education extending over a considerable period of time, an advantage enjoyed by the game participants. He has not had the opportunity to develop a common base of understanding with the participants and director of his game; therefore, in the presentation of results, the game director must use the sponsor's from of reference. Generally, considerable transformation must be anticipated; otherwise, the conclusions of the study may encounter misunderstanding, hostility, or outright disbelief. The burden is on the game director to present results in the language of the sponsor.

c. Acceptability of Results. Management effort following the receipt of the initial force analysis directive is oriented toward constructing a sound methodology and performing a valid analytical effort as a basis for achieving a useful, responsive, and scientifically and militarily acceptable product. Each aspect of the task is critical. The analysis of objectives, selection of evaluation tools, designation of measures of effectiveness, and establishment of a data base are crucial preparatory steps. The conduct of the game by employing sound military principles and using a well-researched and acceptable model is fundamental. The culmination of the entire effort, however, is

the analysis of data and the presentation of results. Management must ensure that the analysis procedures are visible; i.e., that the techniques are explained in detail and that their application at each step of the analysis is thoroughly documented. The methodology then is allowed to stand on its own merits, and the validity of the results derived therefrom is judged on this basis. Effective management of a successful force analysis is not confined to guiding the effort to a timely completion within project resources. Achievement of a product that reflects credit on management and sponsor alike relies on an accurate visualization of the analysis problem, design and application of an appropriate methodology, and a clear and usable presentation of the analysis results.

CHAPTER 3

DYNAMIC GAME PLAY

1. PURPOSE. The purpose of this chapter is to define the game period operational sequence and to describe the operational procedures and techniques of dynamic play with the DIVWAG Model.

2. GAME PERIOD OPERATIONAL SEQUENCE:

a. The use of the Period Processor of the DIVWAG Model in the execution of a war gaming project is referred to as the dynamic game play phase. Dynamic game play commences when all the pregame activities are judged accomplished. The procedural steps in the operational sequence of dynamic game play consist of:

- Preparation of the Game Period Concept
- Conduct of Control Team briefings
  - Game Director's briefing
  - Player Team briefings
- Preparation of operation plans and concepts
- Conduct of Player Team briefings
- Preparation of Unit Scenarios
- Preparation of Battle Paragraphs
- Establishment of computer interface
- Review and analysis of game period output
- Maintenance of game records.

These procedural steps should be followed meticulously by a gaming staff. As each gaming staff gains proficiency in its own operations and in application of the model, the Game Director should establish his own protocol with respect to combining operations and procedures and in the design of functions of procedures not covered herein.

b. Each procedural step in the operational sequence of a game period cycle is described below and is depicted in Figure 3-1. The descriptions which follow reference Figure 3-1.

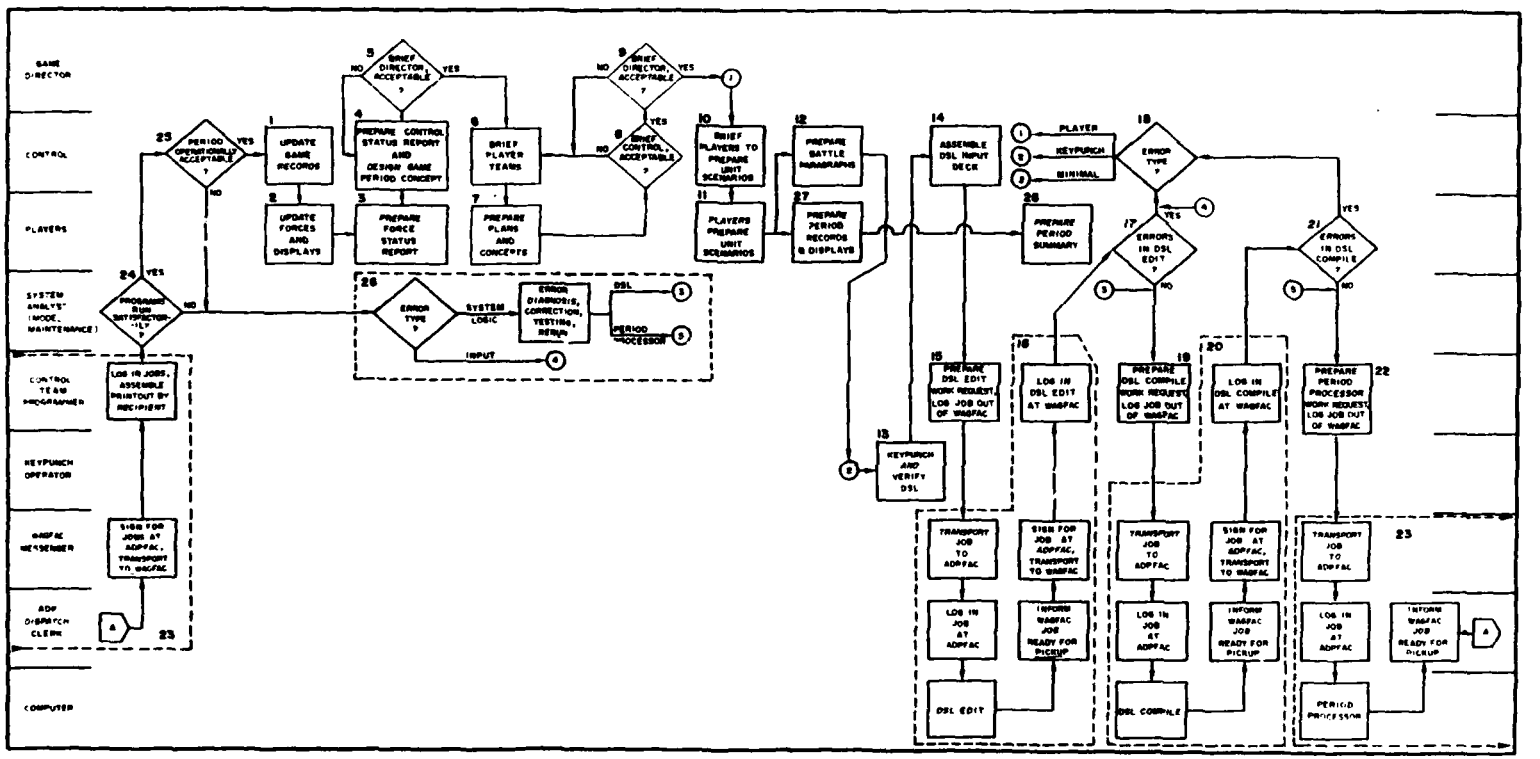

Figure 3-1. Game Period Operational Sequence

(1) The Control Team prepares a Game Period Concept (GPC) for the period of the game next to be played, Block 4. This concept is briefed to the Game Director, Block 5. The Game Director directs attendance at the briefing, which should, as a minimum, include attendance of the Analysis Team and the entire Control Team.

(2) After the Game Director approves the Game Period Concept, the Chief Controller presents the concept, along with appropriate guidance, to the Player Teams, Block 6. In cases where the Game Director modifies the Game Period Concept, these modifications are made prior to implementation by the Player Teams.

(3) The Player Teams use the Game Period Concept and written and/or verbal guidance from the Control Team in preparing their plans and concepts, Block 7. When both teams are prepared, each team presents its concept and plan to the Chief Controller, Block 8. After the Chief Controller approves the plans, a briefing for the Game Director is arranged.

(4) The Control Team briefs the Game Director, Block 9. As the game progresses, these latter two steps may be accomplished simultaneously by asking the Game Director to sit in on the Player Team briefing to the Control Team.

(5) After the Player Team's concepts and plans are approved by the Game Director and the teams are briefed by the Chief Controller, Block 10, players prepare the Unit Scenarios, Block 11, while the Control Team prepares the Battle Paragraphs, Block 12.

(6) Coding sheets are reviewed by the Control Team for obvious errors and then sent for keypunching and verifying, Block 13. Punched cards are returned to the Control Team. The Player and Control Teams then assemble and manually check the deck, Block 14.

(7) A work request is prepared by the Control Team Programmer requesting a DSL EDIT, Block 15. The Support Group handles the administrative processes of taking the job to the DPFO and returning the DSL EDIT output, broken line, Block 16, to the Control Team, where the DSL EDIT is reviewed for errors, Block 17. If there are no errors, the work request for a DSL COMPILE is prepared by the Control Team Programmer, Block 19; the job is taken to the DPFO for processing and retrieved by the Support Group, broken line, Block 20.

(8) If there are errors, the Control Team determines the source and initiates necessary corrective action, Block 18. Serious errors require a recycle and a new DSL EDIT. In the case of minor errors, corrections are inserted and a DSL COMPILE work request is prepared, Block 19.

(9) The Support Group repeats the steps necessary to take the job to the DPFO and return it to the War Game Facility, broken line, Block 20, where the Control and Model Maintenance Teams review the DSL COMPILE for errors, Block 21.

(10) In case of DSL COMPILE errors, the Control Team goes through the same analysis and decision processes as for the DSL EDIT, subparagraph (8) above. When all errors are corrected and a good compile is obtained, a work request for an Operating Instructions run and/or Period Processor run is prepared by the Control Team Programmer, Block 22.

(11) Again the Support Group processes the job, broken line, Block 23, and returns the output to the systems analysts at the War Game Facility.

(12) The systems analysts of the Model Maintenance Team review the output for technical adequacy, Block 24. The Control Team reviews the output for operational acceptability, Block 25. The Player Teams assist the Control Team with this review.

(13) If the game period results are unsatisfactory, a determination is made as to the cause, broken line, Block 26; the possible causes include input errors, model logic errors, and system errors.

(a) If the cause is a system error, the systems analysts in the Model Maintenance Team diagnose, test, and rerun.

(b) If the cause is a model logic error, it is referred to the Model Maintenance Team for correction.

(c) If the cause is an input error, a determination is made as to whether it is a data input or gamer order (DSL) error. If the latter, the same processes are used as those used to review DSL EDIT and COMPILE. If the cause is a data input error, corrected data input is prepared and the data are loaded into the proper file within the computer.

(14) A new game period cycle is initiated when a game period run is deemed satisfactory. The Control and the Player Teams perform the following steps, Blocks 1 through 3, to the degree possible using the Period Output Reports.

(a) Determine end-of-period locations of maneuver units, ascertain whether the FEBA has moved, and review the end-of-period personnel and key equipment strengths and activities of maneuver and combat support units.

(b) Review the significant activities in each battle.

(c) Verify that planned moves of maneuver and combat support units were accomplished.

(d) Review the overall situation in light of the force mission.

(e) The Control Team then prepares a Game Period Concept for the subsequent period based on the force mission, Block 4; the Game Director is briefed on the game period results and Game Period Concept, Block 5; the cycle continues through the steps previously discussed.

(15) The foregoing is a description of the routine procedures for a single game period; however, in order that successive periods can be executed smoothly, two other events are critical, as discussed below (see also Blocks 27 and 28, Figure 3-1).

(a) The game map is posted to reflect game period results as a prelude to each succeeding period, and appropriate game period administrative records are prepared.

(b) As each succeeding game period is turned around and after a successful DSL COMPILE has been obtained, Player Teams prepare a summary of the results of the previous period. These summaries not only provide a basic record of the game but also are necessary for an understanding of game period activities as a prelude to analysis of game results.

c. The remaining paragraphs of this chapter provide procedures and techniques for each step in the operational sequence of dynamic game play.

3. PREPARATION OF THE GAME PERIOD CONCEPT:

a. Introduction:

(1) Several directives and references define the environment in which the gaming action is to take place and chart the general course of the action. These directives include the Game Directive, the Game Plan, the Analysis Plan, and the Game Director's briefing.

(2) To assure that the tactical situation will develop along lines that will carry the action through all the areas of study interest, it is necessary for the Control Team to monitor player orders continuously and to adjust the situation when a necessary situation does not appear to be developing in the natural course of the play.

(3) There are several methods by which the Control Team may adjust the situation. First, the Control Team may order some particular action by one or both Player Teams to create a necessary situation. Usually, the Red Team is used as the foil for this purpose, and the Blue Team is left to play freely within the constraints of assigned missions and specified tactical doctrines.

(4) Second, the Control Team may revise mission timetables. If dynamic play is progressing at a slower pace than originally planned, missions may be terminated early, or force missions may be restated for earlier accomplishment.

(5) Third, the Control Team may inject into the play intelligence information that will lead the player teams into the desired situation. Intelligence information play simulated internally in the Intelligence and Control Model does not provide the required output for this purpose.

Intelligence information for this purpose is developed by the Control Team without use of firm rules; Control Team members must rely upon their subjective judgments in creating this information.

b. Objective. The general objective of the Game Period Concept is to focus the military action into a specific course for the game period in a way that will assure a high probability that the game period will produce an effective contribution toward accomplishment of the game objectives.

c. Purpose. The Game Period Concept serves several purposes:

(1) From some aspects the Game Period Concept serves as the commander of the echelon above the major military unit being gamed.

(2) The Game Period Concept serves as a vehicle for providing Player Teams with the following:

(a) Orientation as to significant military interactions that can be expected to occur during the period as a natural outcome of the military situation, or that will be directed by the Control Team in order to better align the military action along the desired course.

(b) Information and guidance as to likely critical events to provide a basis for Player Team planning for such events.

(c) Special instructions regarding gaming methods and procedures.

(3) The Game Period Concept provides a basis for estimating the duration of the gaming period in terms of game time and for scheduling of activities during the military action preparation phase of the period.

(4) The Game Period Concept provides a vehicle for documentation of Control Team decisions.

(5) The Game Period Concept provides a check point for quality control of gaming activity.

d. Responsibility. The Chief Controller is responsible for preparation of the Game Period Concept.

e. Format and Content. The Game Period Concept is prepared in the format and with the content indicated in Figures 3-2 and 3-3. Details of the content are covered in the next paragraph, and a sample of a completed Game Period Concept is shown in Figure 3-4. The Game Period Concept is first prepared as a draft document and remains in draft form until final approval by the Game Director.

GAME PERIOD CONCEPT (GPC)

Game Period _____ Game _____

Game Time _____ Local Time _____

Classified Log No _____ Duration this Game Period _____ Hrs

Preparation Schedule

Complete GPC _____ Complete DSL Decks _____

Start Control Briefing _____ Complete DSL EDIT _____

Start Control Instructions _____ Complete DSL COMPILE _____

MILITARY CONSIDERATIONS

I. CURRENT MILITARY SITUATION:

a. Red
b. Blue

II. STATUS OF GAME OBJECTIVES:

a. Achieved
b. Objective(s) of this Period

III. SIGNIFICANT MILITARY INTERACTIONS FOR THIS PERIOD:

IV. CRITICAL MILITARY EVENTS:

SYSTEM CONSIDERATIONS

I. STATUS OF OPERATIONAL OBJECTIVES:

a. Objective(s) Achieved
b. Objective(s) for this Period

II. SPECIAL CONSTRAINTS

a. Removed
b. Added
c. Unchanged

INCLOSURES:

_____ 1 - Instructions for Red Team
_____ 2 - Instructions for Blue Team

Figure 3-2. Format and Content of Game Period Concept

GAME PERIOD INSTRUCTIONS FOR

_____ RED TEAM

_____ BLUE TEAM

Game Period _____ Game _____

Game Time _____ Local Time _____

Classified Log No _____ Duration this Game Period ____ Hrs

Preparation Schedule

Complete GPC _____ Complete DSL Deck _____

Start Control Briefing _____ Complete DSL EDIT _____

Start Control Instructions _____ Complete DSL COMPILE _____

MILITARY CONSIDERATIONS

I. STATUS OF GAME OBJECTIVES:

a. Achieved

b. Objective(s) for this Period

II. SIGNIFICANT MILITARY INTERACTIONS FOR THIS PERIOD:

III. CRITICAL MILITARY EVENTS:

IV. COORDINATING INSTRUCTIONS:

SYSTEM CONSIDERATIONS

I. STATUS OF OPERATIONAL OBJECTIVES:

a. Objective(s) Achieved

b. Objective(s) for this Period

II. SPECIAL CONSTRAINTS:

a. Removed

b. Added

c. Unchanged

Figure 3-3. Format and Content of Instructions to Player Teams

GAME PERIOD CONCEPT (GPC)

Game Period 2 Game WAGCAP Test Game

Game Time 010930-011130 Local Time 190800 Apr 72

Classified Log No Uncl Duration this Game Period 2 Hrs

Preparation Schedule

Complete GPC 191100 Apr 72 Complete DSL Deck 191500

Start Control Briefing 191100 Apr 72 Complete DSL EDIT 191600

Start Control Instructions 191130 Complete DSL COMPILE 191900

MILITARY CONSIDERATIONS

I. CURRENT MILITARY SITUATION:

a. Red

(1) Current status by 010930 May 1974, the Red attack on the nose and on the southern portion of the penetration has been stopped and elements of the Blue 3d Armored Division have initiated a counterattack. The leading Red tank regiments sustained significant casualties. Current strength of key Red tank battalions is as indicated below:

Unit	Tank Strength	Pers Strength
1 Bn, 3 Regt, 1 Div	89%	71%
2 Bn, 3 Regt, 1 Div	68%	63%
3 Bn, 3 Regt, 1 Div	30%	23%
1 Bn, 1 Regt, 2 Div	33%	37%
2 Bn, 1 Regt, 2 Div	48%	48%
3 Bn, 1 Regt, 2 Div	75%	73%

Several Red artillery and rocket launcher units also sustained heavy losses.

(2) Current plan. Red will conduct a limited withdrawal in order to straighten their interior lines and permit the most seriously damaged units to break contact.

b. Blue

(1) Present Status.

(a) As of 0930 hours on 7 May 1974 the Blue force has halted the Red advance and is counterattacking to destroy the penetration.

Figure 3-4. Sample of Completed Game Period Concept (continued next page)

(b) In the 3d Armd Div 1st Bde area the 1-41 Armor TF has sustained heavy casualties, 259 personnel and 26 tanks, which have reduced the unit to 52% strength while the 1-42 Armor TF has not reached the LD but has lost 10 personnel and 1 tank.

(c) In the 2d Bde area the 1-43 Armor TF counterattack is continuing in the vicinity of the LD and the unit losses have reached 60 personnel and 2 tanks. The 1-44 Armor TF attack has crossed the LD and has lost 129 personnel and 10 tanks.

(d) The personnel and tank status of the counterattacking TFs is as shown:

	Personnel	Tanks
1-41 Armor TF	52%	29%
1-42 Armor TF	98%	97%
1-43 Armor TF	89%	95%
1-44 Armor TF	76%	72%

(2) Current plans

(a) The 1st Bde plans to relieve the 1-41 Armor TF with the 1-51 Mech Inf TF and to counterattack in the Bde sector with the 1-51 Mech on the left and 1-42 Armor TF on the right.

(b) The remainder of the Blue forces will continue their present missions in the counterattack effort.

II. STATUS OF GAME OBJECTIVES

a. Achieved:

(1) Model Objectives.

(a) Demonstrated the operability of the DIVWAG Period Processor.

(b) Demonstrated the operability of the Game Period Output Processor.

(2) Training Objective. Demonstrated that government personnel are capable to act as control and player team members. All administrative suspense times were met except COMPILE which was one day late.

(3) Military Objectives. All military objectives were met except two.

(a) Only the assault battalions of the counterattack force effected a passage of lines. The original objective should have been so stated.

(b) There were no INC generated attack helicopter sorties because a last minute decision was made to RETAIN all attack helicopters.

b. Objectives of this Period:

Figure 3-4. Sample of Completed Game Period Concept (continued)

(1) Model Objective. Demonstrate an improvement in the operability of the DIVWAG Period Processor in view of the fact that the first period required two weeks for a successful run.

(2) Training Objective. Demonstrate an improved capability on the part of government personnel by meeting all suspense periods established.

(3) Military Objectives:

(a) Having completed DSL-directed preparatory fires, achieve credible game results by relying on systemically generated fires by artillery and Air Force close air support.

(b) Reflect the impact of Red's precarious situation by producing data revealing his combat power attrition while trying to consolidate.

(c) Reflect the masking of all of Blue 8th Mech Div direct fires except those of the 1st Bn, 2d Bde.

(d) Depict a variety of attack, defend, delay situations which will produce combat results data for analysis purposes.

III. SIGNIFICANT MILITARY INTERACTIONS FOR THE PERIOD

a. Intense ground combat in Red 2d Tank Division zone.

b. Continuation of Blue passage of lines operation.

c. Combat units on each side may be expected to reach termination criterion. However, the Red situation dictates that no conditional termination criteria be applied this period.

SYSTEM CONSIDERATIONS

I. STATUS OF OPERATIONAL OBJECTIVES

a. Objectives Achieved. None.

b. Objectives for this Period. Same.

II. SPECIAL CONSTRAINTS

a. Removed:

(1) No unit will engage in more than one named battle at any one time.

(2) Red forces, except those opposing the Blue 3d Armored Division, will be attempting a firepower kill throughout the period.

b. Added:

Figure 3-4. Sample of Completed Game Period Concept (continued)

(1) No DSL-directed artillery missions.

(2) No DSL-directed CAS sorties.

(3) Blue attack helicopters will be held in a RETAIN status.

(4) Refrain from non-essential use of TRANSFER orders.

INCLOSURES:

_____ 1 - Instructions for Red Team
_____ 2 - Instructions for Blue Team

Figure 3-4. Sample of Completed Game Period Concept (concluded)

f. Preparation Procedures. The following procedures constitute a check list for rapid preparation of the Game Period Concept.

(1) Heading. Enter the first five items of heading identification information in the Game Period Concept form; the remaining heading items will be entered later.

(2) Military Considerations. Prepare and enter synopsis of body information in the Game Period Concept form.

(a) Current Military Situation. Summarize aspects important to game objectives; enter this summary in the Game Period Concept form.

(b) Status of Game Objectives:

1. Review objectives of previous game period and determine if there are any critical objectives yet to be achieved; summarize objectives achieved and enter this summary in the Game Period Concept form.

2. Based on the results of subparagraph 1, make selection of objectives for this period and summarize them; enter this summary in the Game Period Concept form.

(c) Significant Military Interactions Planned for This Game Period. A significant military interaction is defined as a military interaction between opposing forces wherein the nature of the interaction must be investigated in order to provide data and insights and inferences from which can be drawn conclusions essential to the achievement of the study objectives. Typical examples of significant military interactions include both explicit and implicit requirements; e.g.,

- Engagement of a specific Red unit by a specific mix of Blue artillery. (Explicit)
- Use of specific Blue atomic demolition munitions in a specific natural barrier line to delay specific types of Red units. (Explicit)
- Conduct a variety of delaying operations in determining how a given Blue division force can best conduct a delaying action from one defensive line to another defensive line. (Implicit)

1. Review significant military interactions of previous game periods.

2. Summarize results.

3. Review scenarios and instructions.

4. Based on the results of subparagraphs 1, 2, and 3 above, plan significant military actions for this game period and summarize the overall scheme of action; enter this summary in the Game Period Concept form.

5. Estimate the times at which significant interactions will take place.

6. Estimate the game time at which the situation will require player intervention to maintain game integrity.

7. Set the tentative duration of this game period; enter in the Game Period Concept form heading.

8. Advise the chief of each Player Team of the tentative duration of the game period so the team players can begin preliminary planning

9. Establish which individual Blue and Red military units will be involved, and make separate lists of these units to provide bases for issuing instructions and for check list for later review of operation orders.

(d) Critical Military Events. A critical event is defined as any military event likely to result in at least a temporary decided advantage to one of the protagonists, and which advantage, if not countered, may become decisive. Typical examples of critical events include:

- First employment of nuclear weapons
- After first employment of nuclear weapons, a concentrated employment of nuclear weapons
- First encounter with a new and highly effective weapon system
- Attacker penetration so rapid that defender must make a crisis decision on counterattacking, containing, or withdrawing
- Reduction of the military effectiveness of a unit to a value less than its break point.

Determine likely critical events for the coming period. Establish which individual Blue and Red military units will be involved, and make separate lists of these units to provide bases for issuing instructions and for check list for later review of input orders.

(3) System Considerations. Prepare and enter considerations affecting the exercise of the division war game system. For this purpose the system comprises the war game model, the facilities in which the model is exercised (DPFO and War Game Facility), and the game staff organization.

(a) Status of Operational Objectives. Enter those system operational objectives established by, or implied from, the Game Directive.

1. Objectives Achieved. Enter those system operational objectives achieved as a result of game play through the close of the preceding period. Examples of such entries are:

- Computer time-to-combat time ratio is 0.83:1.00; objective is 1.00:1.00. Objective exceeded by 0.17:1.00
- Blue helicopters detected and killed Red tanks under nighttime conditions.

2. Objectives for This Game Period. Enter those system operational objectives that are expected to be achieved by the execution of this game period. These may be objectives that have not yet been achieved or objectives that have been achieved but for which verification of achievement is needed. Examples of such entries are:

- Game turnaround time-to combat time ratio of 1.00:1.00
- Red missile units attack Blue targets in order of priority; maneuver battalions, command post, and supply installation.

(b) Special Constraints. Prepare and enter any special constraints to be imposed or removed during this game period. Additionally, identify those special constraints previously imposed that remain in effect for this period. Examples of special constraints are as follows:

- DPFO will be nonoperational 030800-031200 Jan 71 for maintenance.
- War Game RAD is accorded Priority 3 by USTRADOC.
- Camera equipment of the War Game Facility is inoperative until 080800 Jan 71.
- Blue DSL FLY missions will penetrate no deeper than Weser River; RED AD task organization is not loaded beyond that line.

(4) Inclosures. Place X in appropriate space under Inclosures.

(5) Game Period Instructions for Team. In a closed game, instructions to Player Teams are prepared separately for each team and formatted as separate inclosures to the Game Period Concept. Except for the coordinating instruction, all of the information found in these instructions is lifted directly from like titled items of the body information of the Game Period Concept form. Only items pertinent to the team addressed are included. Care must be exercised in the segregation of privileged information to prevent its disclosure to the opposing team.

4. CONTROL TEAM BRIEFING. This operation involves two functional briefings by the Control Team, one for the Game Director and one for the Player Teams. Each briefing is discussed separately.

a. Control Team Briefing of the Game Director:

(1) Purpose. The purpose of this briefing is to permit the Game Director to monitor the planned military action for this game period before it is initiated in order to determine if the Game Period Concept draft is adequate and in general consonance with the Game Plan. This briefing also provides a check point for quality control.

(2) Responsibility. The Chief Controller is responsible for conducting this briefing.

(3) Attendees. Based upon recommendations of the Chief Controller, the Game Director will dictate attendance. Care should be exercised to ensure Analysis Team representation when such team is a part of the war game staff.

(4) Place. Normally this briefing will be conducted in the Control Team game room.

(5) Decision. At the conclusion of the briefing, the Game Director will decide if the Game Period Concept draft needs revision or if it is acceptable as is.

(a) If the Game Period Concept draft needs revision, the Game Director will instruct the Chief Controller as to the specific nature of the revisions.

(b) When the Game Period Concept draft is finally acceptable, the Game Director will approve it; and the action will proceed to the briefing of Player Teams.

(6) Documentation. A copy of the approved Game Period Concept will be provided by the Chief Controller to each element requiring it for analysis purposes.

b. Control Team Briefing of the Player Teams:

(1) Purpose. The purpose of the briefings is to orient the Player Teams in those portions of the Game Period Concept draft pertinent to their particular teams for this game period to enable the teams to prepare their own operational concepts for the period in consonance with the Game Period Concept draft. Except in open games, separate briefings will be held for opposing Player Teams.

(2) Responsibility. The Chief Controller is responsible for the conduct of the briefings. In the interest of shortening game turnaround time, the Chief Controller may delegate to his Deputy Chief Controller or to Senior Controllers, responsibility for the actual briefing presentations; in this way the briefings for opposing teams may be conducted simultaneously.

(3) Attendees. The Chief Controller will dictate attendance.

(4) Place. For all games except open games, briefing of the Blue Team should be conducted in the Blue Team game room and briefing of the Red Team in the Red Team game room. For open games one briefing for both teams together will suffice, and it may be conducted in either team's game room or in the Control Team game room.

(5) Documentation. The Chief Controller will provide copies of the "Blue Team Game Period Instruction for Team" form to the Chief, Blue Team, and copies of the "Red Team Game Period Instruction for Team" form to the Chief, Red Team.

5. PREPARATION OF OPERATION PLANS AND CONCEPTS:

a. Introduction. This operation requires six steps to be performed by each player team in accordance with the general procedures specified in FM 101-5,[1] with minor modifications. Each step is summarized, with no attempt made to repeat detailed procedures covered by the field manual.

b. Priority of Player Responsibilities. Player Teams have two primary responsibilities related to their military function in the conduct of gaming activities. These two responsibilities may appear to be in conflict at times, but they are stated here in terms of their relative priorities in order to provide perspective.

(1) First Priority. The Player Team responsibility having first priority is to conduct military operations of assigned forces in a manner that will best support the game objectives.

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1. FM 101-5, Staff Officers' Field Manual - Staff Organization and Procedures, 14 June 1968.

(2) Second Priority. The Player Team responsibility having second priority is to conduct military operations of assigned forces in a manner that will best reflect military staff and command abilities of the players.

c. Deduction of Mission. Based on the instructions provided to his team in the Controller's briefing, supplemented by other previously issued documents and instructions, each Player Team Chief deduces his mission for this game period. Through mission analysis, he determines the specified tasks to be performed to accomplish the mission and any implied tasks that he considers appropriate to call to the attention of his staff players.

d. Provision of Staff Information. Based on the deduced mission, Player Team members functioning as the military staff provide to their Player Team Chief available information pertinent to the mission.

e. Commander's Guidance. Based on the information provided by his staff, the Player Team Chief completes his mission analysis and issues his planning guidance.

(1) Planning guidance is the Player Team Chief's assistance to his staff players in preparing or revising their estimates. The amount of planning guidance varies with each mission, the volume and validity of information available, the situation, and the experience of the Player Team Chief and his staff players.

(2) Planning guidance is not limited to one specific step in the sequence of actions; however, initial guidance should precede the preparation of staff estimates. The Player Team Chief normally includes in his initial guidance his restated mission as determined by his mission analysis; his general plan for using fire support and nuclear weapons, if appropriate; any other factors that he considers important at this time; and any courses of action that he wishes developed.

f. Staff Estimates:

(1) Based on the mission and planning guidance received, staff players prepare their informal Staff Estimates as required by the military situation and the game objectives.

(2) The informal Staff Estimates themselves need not be made into written records; if the situation dictates a written estimate for the record, then a formal estimate should be made, including essential portions of the standard estimate.

(3) Staff Estimates result in recommendations as to what actions the Player Team Chief should take to accomplish the team mission.

g. Commander's Estimate and Concept:

(1) Based on the recommendations made by his staff players, the Player Team Chief prepares his own estimate and announces his Commander's Decision to his staff players. The Commander's Decision is recorded.

(2) Following the decision statement (the last step of the estimate), the Player Team Chief provides his staff players with his overall concept of how the operation will be conducted (Commander's Concept), which is an amplification of his decision, and explains any aspects he considers necessary. The Commander's Decision, together with the Commander's Concept, provides the basis for preparation of Paragraph 3a of the operation order.

h. Operation Orders:

(1) Formal operation orders need to be prepared by both Player Teams for the start of a game. These orders are based on guidance provided by the Game Director.

(2) Subsequent to the first game period, the term "operation order" is synonymous with "concept of operations;" as will be seen in later discussions each Player Team's concept is made a matter of record in the game period narrative.

6. PLAYER TEAM BRIEFING TO CONTROL TEAM AND GAME DIRECTOR:

a. As soon as Player Teams have completed their planning processes and prepared a concept of operation, they announce their readiness to brief those plans and concepts.

b. During the early game periods, and until game cycle operations become stabilized, it is well that these briefings be presented only to the Control Team; however, as soon as the operations do become standard, time and effort will be conserved if the Game Director will attend the briefing, together with any other managers deemed appropriate.

c. The purpose of these briefings is to provide the Game Director and the Chief Controller with the opportunity to ensure that guidance of the Game Period Concept is being followed; or, if it is not, to provide the Player Team Chief an opportunity to present his rationale for deviation.

d. When the plans and concepts of both teams have been approved, Player Teams immediately commence preparation of the gamer input orders.

7. PREPARATION OF UNIT SCENARIOS:

a. The DIVWAG Scenario Language (DSL) is the source for gamer-initiated orders to units in the DIVWAG Model. Appendix B to this volume contains the entire vocabulary of that language. All gamers must have a comprehensive understanding of the DSL in order to run a game efficiently.

b. Although instructions for the use of DSL are contained in Appendix B, this paragraph emphasizes several considerations in its use as it relates specifically to causing a simulated unit to perform some act during a game period.

(1) A simulated unit in the DIVWAG Model will perform certain functions without being directed by a gamer to do so:

(a) In the absence of orders, all units will remain in place.

(b) Artillery units will enter the TACFIRE system and respond appropriately.

(c) Air defense units will expend ammunition against aircraft.

(d) All units will consume food and expend POL.

(e) All units will seek appropriate protection when attacked by artillery or aircraft.

(f) All units will operate available sensors.

(g) All units will receive resupply of consumables, personnel replacements, and major end items if appropriate.

(h) Mission capable units will fly attack helicopter sorties and high-performance close air support missions against appropriate targets.

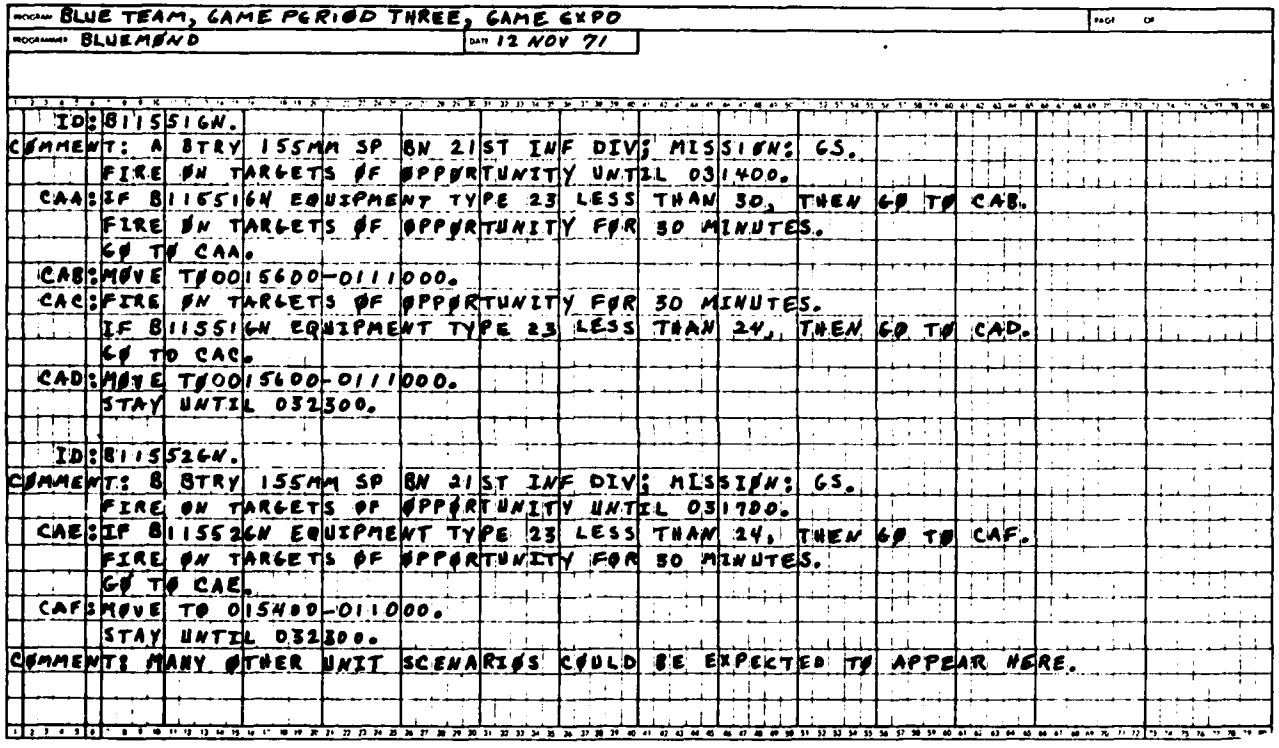
(i) Engineer units will respond to requests from other units to breach obstacles or build facilities.

(2) All other activities must be directed through use of DSL.

(3) In order for a unit to respond to orders it must have a name, the eight-character alphanumeric unit identification (UID). It must be a resolution unit; i.e., it must have people and it must be assigned a geographical location.

(4) All orders to a single unit must be included in a single Unit Scenario; i.e., in a given game period any one unit can be given orders under its UID but a single time. If the UID is used for a second set of orders the input deck will not be compiled.

c. Unit Scenarios are prepared by Player Team members as prescribed by the Player Team Chief. Standard program coding forms are used as shown in Figure 3-5. Each Unit Scenario consists of three elements, assembled in the order listed: a unit identification, a comment card, and the list of procedure statements.


PROGRAM BLUE TEAM, GAME PERIOD THREE, GAME EXPO
PROGRAMMER BLUEMEND
DATE 12 NOV 71
PAGE OF

```
    ID:B115SIGN.
COMMENT: A BTRY 155MM SP BN 21ST INF DIV; MISSION: GS.
         FIRE ON TARGETS OF OPPORTUNITY UNTIL 031400.
   CAA:IF B115516N EQUIPMENT TYPE 23 LESS THAN 30, THEN GO TO CAB.
         FIRE ON TARGETS OF OPPORTUNITY FOR 30 MINUTES.
         GO TO CAA.
   CAB:MOVE TO0015600-0111000.
   CAC:FIRE ON TARGETS OF OPPORTUNITY FOR 30 MINUTES.
         IF B115516N EQUIPMENT TYPE 23 LESS THAN 24, THEN GO TO CAD.
         GO TO CAC.
   CAD:MOVE TO0015600-0111000.
         STAY UNTIL 032300.

    ID:B115526N.
COMMENT: B BTRY 155MM SP BN 21ST INF DIV; MISSION: GS.
         FIRE ON TARGETS OF OPPORTUNITY UNTIL 031900.
   CAE:IF B115526N EQUIPMENT TYPE 23 LESS THAN 24, THEN GO TO CAF.
         FIRE ON TARGETS OF OPPORTUNITY FOR 30 MINUTES.
         GO TO CAE.
   CAF:MOVE TO 015400-011000.
         STAY UNTIL 032300.
COMMENT: MANY OTHER UNIT SCENARIOS COULD BE EXPECTED TO APPEAR HERE.
```

Figure 3-5. Sample Coding Sheet for Unit Scenarios

d. To facilitate review and proofing of Unit Scenarios and to facilitate keypunching operations, a standard set of indentations is recommended as specified herein. (Figure 3-5)

(1) The unit identification is preceded by the characters "ID". These characters begin in column 4 of the coding form.

(2) "COMMENT" cards begin in column 1 of the coding form.

(3) All three-character labels begin in column 3.

(4) All orders begin in column 7.

8. PREPARATION OF BATTLE PARAGRAPHS

a. Detailed instructions on the preparation of Battle Paragraphs are included in Appendix B to this volume; however, a brief discussion of procedures in this paragraph will assist the gaming group to expedite preparation.

b. At the conclusion of the Player Teams' briefings to control (Paragraph 6, above) it is recommended that Control and Player Team Chiefs "rough out" the individual battles foreseen for the coming period. This enables each team, as well as the Control Team to provide guidelines for contingencies.

c. The Control Team is responsible for preparing the Battle Paragraphs as prescribed in Appendix B. As stated therein, each battle must have at least one conditional. Actually, most battles will have more than one such conditional as the only means to provide for contingencies. Each battle conditional must have an associated labeled order in the Unit Scenario of each unit in the Battle Paragraph. Player Team personnel cannot prepare these orders at the time they are preparing Unit Scenarios because the battle logic will not have been completed; therefore, it is recommended that each Player Team designate one man to work with the Control Team in the preparation of Battle Paragraphs and the associated Unit Scenario label orders. This should be done as early as possible but no later than completion of Unit Scenarios by the Player Teams.

9. COMPUTER INTERFACE PROCEDURES:

a. Processing Coding Forms:

(1) When all Unit Scenarios have been coded onto standard program coding forms, they should be reviewed within the Player Teams for obvious errors. When obvious errors are corrected, a copy should be made and retained and the original forwarded to the Control Team.

(2) Within the Control Team, the Blue and Red Controllers review the coding forms and recommend disposition to the Chief Controller. If errors are noted in logic, the recommendation should be to return the forms to the

Player Team. If there are no obvious errors or if the errors are minor, the recommendation to the Chief Controller should be to send the forms to the keypunch operator for keypunching and verifying.

(3) The keypunched cards should be returned directly to the originator of the coding forms.

(4) When all keypunching is complete, each team assembles its card deck and passes it to the Control Team for final assembly. The Control Team adds the Battle Paragraphs, together with the appropriate data and header cards and prepares the assembled input deck for an edit.

b. Computer Interface Processing. Computer interface processing refers to those procedures which relate to actual computer operations, once the DSL deck is assembled by the Control Team. These processing procedures are explained in detail in Appendix A. In brief, they include:

(1) Preparation and assembly of the control card deck for a DSL EDIT and associated administrative procedures.

(2) Preparation and assembly of the control card deck for a DSL COMPILE and associated administrative procedures.

(3) Preparation and assembly of the control card deck for Operating Instruction processing and the associated administrative procedures.

(4) Preparation and assembly of the control card decks for processing the game period through the Period Processor and the Period Output Processor.

10. REVIEW AND ANALYSIS OF GAME PERIOD OUTPUT. At the end of each dynamic game cycle two types of period output are produced; the technical printout from the Period Processor, used for diagnostic purposes by the Model Maintenance Team, and the period reports from the Period Output Processor. Obviously, neither of these outputs is available to initiate the first period; therefore, the first Game Period Concept is prepared based upon guidance from the Game Directive, the Game Plan, and verbal guidance from the Game Director. Subsequent game period turnarounds commence with an analysis of the output, each of which is discussed below.

a. Technical Printout:

(1) Purpose. The primary purpose of the analysis of the technical printout from the Period Processor is to detect any technical errors in the operation of the model programs, or any unsatisfactory results of program operations, and to permit determination of the technical acceptability of the results.

(2) Responsibility:

(a) The Model Maintenance Team is responsible for the conduct of the technical analysis and for the determination of technical acceptability.

(b) The Analysis Team will conduct a subsequent technical analysis of this output from the standpoint of technical acceptability for game results analysis.

(c) The Control Team is responsible for providing assistance and guidance, as requested, to both Model Maintenance and Analysis Teams.

(3) Analysis Procedures:

(a) The technical analysis concerns three primary areas of interest.

1. Acceptability of time ranges (game time at the end of the run, computer running time versus game time).

2. Legitimacy of Period Processor termination.

3. Interpretation of printed diagnostic statements.

(b) When the analysis indicates unacceptable results, a determination must be made concerning necessary changes.

1. If errors stem directly from unsatisfactory program operations, the Model Maintenance Team will determine the cause and the solution and report these facts to the Chief Controller and the Game Director.

2. If errors stem from gamer input, either constant data or DSL, the Model Maintenance Team will call on the Chief Controller to determine corrective action. In turn, the Chief Controller will report the facts to the Game Director.

(c) When the analysis indicates an acceptable run, this fact will be reported to the Chief Controller and the Game Director.

b. Period Output Reports:

(1) Purpose. Analysis of Period Output Reports provides the basis for a decision regarding acceptability of gaming procedures and the operational acceptability of the results. See Appendix A for examples and a discussion of contents of the Period Output Reports.

(2) Responsibility:

(a) The Chief Controller is responsible for ensuring that the analysis is made to determine operational acceptability. Within the Control Team, Blue and Red Controllers will review reports of their respective teams. The Chief Controller and the Deputy Chief Controller will spot check selected portions of the reports as specified by the Chief Controller.

(b) Each Player Team Chief is responsible for ensuring that the analysis is made to determine operational acceptability.

(c) The Model Maintenance and Analysis Teams will provide technical advice and analysis assistance as requested by the Chief Controller.

(3) Analysis Procedures:

(a) Within the Control Team, the emphasis of the analysis it to determine:

1. Was the concept of operation implemented acceptably?
2. What is the status of mission-essential equipment?
3. Have units reached a termination criterion?
4. What are units' loss rates?
5. What significant conditionals were met during the period?
6. Were the game period objectives attained?
7. What is the overall acceptability of the game period?

(b) Each Player Team's in-depth analysis is made to determine:

1. Was the concept of operation implemented acceptably?
2. What is the status of mission-essential equipment?
3. Have units reached a termination criterion?
4. What is the status of supply actions?
5. What are the loss rates of significant units in the force?
6. What is the tactical integrity of the force?
7. What is the overall acceptability of the game period?

(c) When the analysis indicates unacceptable results, a determination must be made as to the remedial actions. The Chief Controller will consult with Model Maintenance and Analysis Teams to arrive at the preferred course of action. This course of action will be presented to the Game Director for approval, necessary changes will be made, and the necessary corrective action taken.

(d) When the analysis indicates the results are operationally acceptable, the Game Director will be so advised, and approval to initiate game period turnaround will be requested.

c. Error Correction:

(1) Irrespective of the error type, except for DPFO errors, the corrective action should be a coordinated process among Model Maintenance, Analysis, and Control Teams. This coordination is necessary to ensure that each team understands the impact of the correction on game operations.

(2) In general, errors fall into two categories, operational and technical.

(a) Operational errors may be due to faulty composition of Unit Scenarios or Battle Paragraphs, exceeding some limiting constraint of the model; or inadequate, inaccurate, or inconsistent constant data input entries.

(b) Technical errors may be due to faulty model logic or technical rules.

(c) The Control Team, in coordination with Model Maintenance and Analysis Teams, is responsible for the correction of DSL errors. Other operational errors should be corrected as a coordinated effort between the Control Team and the Model Maintenance Team with liaison to the Analysis Team.

(d) The Model Maintenance Team, in coordination with Analysis and Control Teams, is responsible for the correction of technical errors. The Model Maintenance Team is also responsible for coordination with the DPFO in case of DPFO errors.

11. MAINTENANCE OF GAME RECORDS:

a. Game records consist of the following items, each of which is discussed further in Appendix A to this volume:

- Game Period Concept
- Compile of Gamer Orders
- Game Period Reports
- Graphics
- Game Period Narratives

b. The Game Period Narratives are as important to the documentation of a war game as are the Game Period Concepts. They should be concise, vivid descriptions of significant events of a game period, and they should be indicative of the extent to which game period objectives were achieved, as embodied in the Game Period Concept. Figure 3-6 contains an outline of a Game Period Narrative format which is considered appropriate for most DIVWAG applications. Instructions as to timing its preparation are included in Appendix A to this volume.

GAME PERIOD NARRATIVE

Section I. IDENTIFICATION

1. GAME. _____.

2. DYNAMIC GAME PERIOD REPORTED. _____.

3. GAME TIME COVERED. From _____ to _____.

Section II. SUMMARY OF PERIOD

4. SITUATION AT END OF PERIOD. (Control Team prepares after review of Player Teams' reports.) Refer to any appendages, such as situation graphics. Cover any particularly significant aspects of the situation.

5. OPERATIONS DURING PERIOD:

a. Blue:

(1) Combat. Under a separate lettered subparagraph, provide a brief narrative resume of the combat actions and any other significant events of each brigade and the separate combat units, if any. This narrative should read much the same as an after action report covering the brigades or separate combat elements, as differentiated from separate battle reports on each subelement, by battle name.

Figure 3-6. Game Period Narrative Outline (continued on next page)

(2) Combat Support. A separate subparagraph should be used to summarize each type combat support activity to be reported; e.g.,

(a) Artillery

(b) Attack Helicopter

(c) Air Force CAS

(d) Engineer

(e) Etc.

(3) Combat Service Support. A separate subparagraph should be used to summarize each combat service support activity to be reported.

b. Red. Red subparagraphing should follow the same sequence and the same philosophy as Blue.

6. OPERATIONAL FACTORS INFLUENCING GAME RESULTS. Cover that pertinent information not appropriately covered in preceding paragraphs; e.g., weather, terrain, and visibility.

7. ANALYSIS OF OPERATIONS DURING THE PERIOD:

a. Blue. Present a brief analysis of the operations by Blue as a force. Include significant accomplishments and/or failures.

b. Red. Present a brief analysis of the operations by Red. Address division level forces. Include significant accomplishments and/or failures.

c. Analyze achievement of game period objectives.

8. SYSTEM CONSIDERATIONS AFFECTING GAME RESULTS. (Prepared by Chief Controller.)

a. Present conclusions concerning anomalies caused by constant data and gamer orders input.

Figure 3-6. Game Period Narrative Outline (continued)

b. Present recommendations for system modification which would improve game results.

c. Present recommendations for side analyses/sensitivity tests.

Section III. PLANS FOR NEXT PERIOD

9. CONCEPT OF OPERATION:

a. Blue. A concise statement of the concept as presented to Control Team at the briefing.

b. Red. Same as 9a above.

10. FORCE MISSIONS:

a. Blue. Control Team prepares after receipt of Paragraph 9a from Blue.

b. Red. Control Team prepares after receipt of Paragraph 9b from Red.

11. PLANS FOR THE PERIOD. The same sequencing and philosophy is used in structuring this paragraph as was used in structuring Paragraph 5.

a. Blue. Summarize operations planned. Include any deviations from original concepts or from doctrine.

(1) Combat Elements

(2) Combat Support Elements

(3) Combat Service Support Elements

b. Red. Same as for Blue.

Figure 3-6. Game Period Narrative Outline (concluded)

APPENDIX A

GAME PERIOD CYCLE OPERATIONS

1. INTRODUCTION. This appendix contains amplifying discussions on operations and procedures presented in Chapter 3, Dynamic Game Play, of this volume. Specifically, the detailed administrative procedures associated with computer interface are covered herein as are descriptions of period reports and the analysis thereof.

2. COMPUTER INTERFACE PROCEDURES:

a. Stages of Processing. There are four separate and sequential stages in DIVWAG computer processing; DSL EDIT, DSL COMPILE (Orders Input Processing), Operating Instructions Load, and Period Processing. Although each stage may be considered separate, the general procedures for all are similar. They differ in detail of control card decks and work request forms, and each stage is discussed in depth in the subparagraphs that follow.

b. DSL EDIT:

(1) General. The primary function of the EDIT process is to identify the existence and, insofar as possible, the nature of errors in the DIVWAG Scenario Language (DSL) deck. While the gaming staff must prescribe and employ quality control measures in deck preparation and assembly, there is a point beyond which manual measures are economically unsound. For example, two members of each gaming element (Blue Team, Red Team, and Control Team) could spend over an hour checking punched cards to ensure an error-free deck, but the EDIT process for the assembled deck may require but 2 to 3 minutes of computer time. When the order deck has gone through the EDIT process errors are flagged, and a legible listing of the input is produced; therefore, it is suggested that liberal use be made of this capability as a means to speed game period turnaround.

(2) Processing Procedures:

(a) General. The Control Team Programmer, under the supervision of the Chief Controller, processes the DSL decks. The assembled deck is passed to the Control Team Programmer after the Chief Controller has added the DSL control cards (see Appendix B to this volume). The Control Team Programmer integrates the EDIT control deck. See Figure A-1. It is not necessary or recommended to reload the data file if it already contains the data to be used unless the run immediately preceding this was a Period Report run. The omission of that step saves time and also prevents the possibility of loading the file with the incorrect tape. The data file must be reloaded after a Period Report run.

(b) Work Request. A work request form is prepared. See Figure A-2.

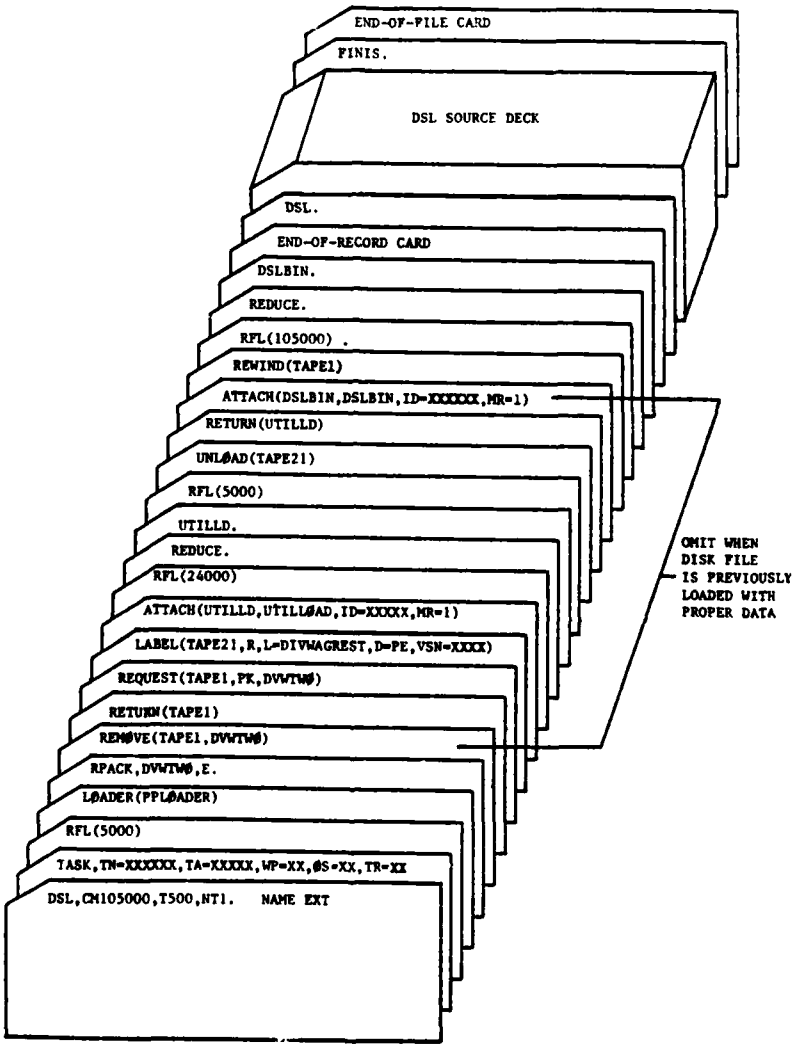
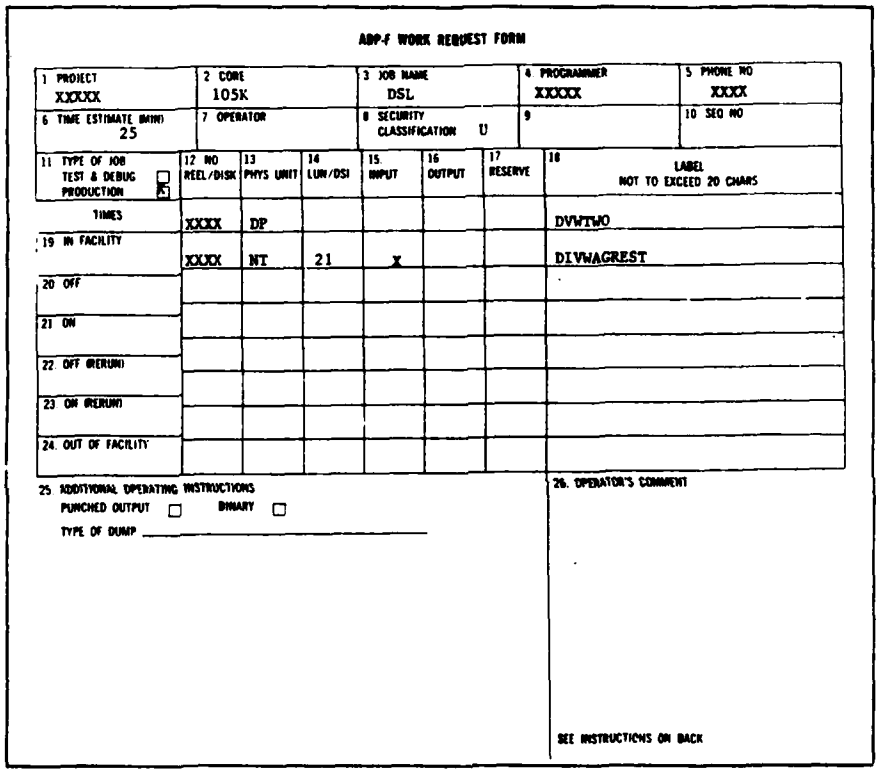


Figure A-1. DSL EDIT Deck Assembly



ADP-F WORK REQUEST FORM

1 PROJECT	2 CORE	3 JOB NAME	4 PROGRAMMER	5 PHONE NO
XXXX	105K	DSL	XXXX	XXXX
6 TIME ESTIMATE (MIN)	7 OPERATOR	8 SECURITY CLASSIFICATION	9	10 SEQ NO
25		U		

11 TYPE OF JOB	12 NO REEL/DISK	13 PHYS UNIT	14 LUN/DSI	15 INPUT	16 OUTPUT	17 RESERVE	18 LABEL NOT TO EXCEED 20 CHARS
TEST & DEBUG ☐ PRODUCTION ☐							
TIMES	XXXX	DP					DVWTWO
19 IN FACILITY	XXXX	NT	21	X			DIVWAGREST
20 OFF							
21 ON							
22 OFF (RERUN)							
23 ON (RERUN)							
24 OUT OF FACILITY							

25 ADDITIONAL OPERATING INSTRUCTIONS
PUNCHED OUTPUT ☐ BINARY ☐
TYPE OF DUMP _____

26. OPERATOR'S COMMENT

SEE INSTRUCTIONS ON BACK

Figure A-2. Sample Work Request Form for DSL EDIT

1. Item 1. Enter code name assigned to the gaming project.

2. Item 2. Enter computer core requirements for this job.

3. Item 3. Enter DSL.

4. Item 4. Enter last name of Control Team Programmer.

5. Item 5. Enter telephone extension of Control Team Programmer.

6. Item 6. Enter estimate of machine time required.

7. Items 7, 9, and 10. Leave blank.

8. Item 8. Enter U for unclassified.

9. Item 11. Enter X in production box.

10. Items 12 through 18. Consult with the Model Maintenance Team for the correct disk pack entry for the first row of column 12. If the data file is to be reloaded, the reel number and label of the appropriate dump tape are entered on the second row; otherwise, the remaining rows are left blank.

11. Items 19 through 24, and 26. Leave blank.

12. Item 25. Enter special instructions such as notification of completion and relationship to other runs.

(c) Logging Out of Deck. In the Log Journal the Control Team Programmer enters information from items 1 and 3 of the work request form and in the out column, enters the date and time out.

(d) Transportation of Deck to ADP Facility. The messenger transports the items to the ADP Facility, using transportation he summoned at the time he was alerted, and delivers the items to the DPFO Job Control Point. He then returns to the War Game Facility.

(e) DPFO. At this point, the DPFO assumes responsibility for logging the job into the facility, establishing a priority for the job, entering the job onto the machine, executing the job, and notifying the Control Team Programmer that the job is completed.

(f) Transportation of Deck to War Game Facility. Upon notification that the job has been completed, the messenger summons transportation and proceeds to the DPFO Job Control Point. There he:

1. Checks the job to see that the work request form, the DSL EDIT deck, and the printout all correspond, and that no materials from other jobs have been included inadvertently.

2. Signs for the completed job by initialing the original copy of the work request form, which he leaves at the DPFO.

3. Transports the DSL EDIT deck, the printout, and the duplicate copy of the work request form to the War Game Facility and delivers all items to the Control Team Programmer.

(g) Logging In of Deck. In the Log Journal, the Control Team Programmer finds the previous Logging Out entry for this job, and in the In Column enters the date and time in.

(h) Removal of Control Deck. The Control Team Programmer separates the DSL deck from the EDIT control deck; secures the DSL deck; and consolidates, secures, and stores the EDIT control deck.

(i) Filing of Work Request Form. The Control Team Programmer then files the work request form in his file of completed work request forms.

(j) Delivery of DSL Deck and EDIT Printout. The Control Team Programmer delivers the DSL deck and the EDIT printout to the Records Controller of the Control Team. This completes the processing of the data through EDIT.

(3) Error Analysis and Correction:

(a) The Chief Controller is responsible for the analysis, revision, and reassembly of the deck. He will call upon the Model Maintenance Team for any required assistance in analyzing the battle paragraphs.

(b) DSL EDIT processing provides error diagnostics to the analyst in the form of diagnostic remarks on the printout. The diagnostic statements are specific and pinpoint the error directly. Errors are identified as either fatal or warning.

1. Fatal Errors. An error indicated as fatal would always cause incorrect results and must be corrected before a successful DSL COMPILE can be completed.

2. Warning Errors. An error condition identified as a warning is likely to cause incorrect results. A thorough analysis of the technique used should be made to insure that the desired result will be achieved.

(c) Minor errors are corrected by entering directly on the punched card the number of the column in which the error correction begins, followed by a slash(/), followed by the correct entry. If the correction includes blank columns, such are indicated either by a carat (^) or by a bar b (b). Within each gaming group, a single convention should be adopted so as not to confuse the keypunch operator. The indicated correction must be located on the faulty card so that the keypunch operator can read it while the faulty card is in the duplicating section of the machine.

(d) Extensive errors on a single card should be corrected by preparing the correct data on a standard coding form and punching a new card.

(e) When all errors are corrected and the deck reassembled, the Chief Controller decides if a new EDIT is desirable or if the deck can go directly to COMPILE. If a new EDIT is necessary the procedures are repeated; if not necessary, the following procedures are initiated for a COMPILE.

c. DSL COMPILE:

(1) A DSL COMPILE processes the DSL deck through the Orders Input Processor. The primary function of this processor is to translate the DIVWAG Source Language (DSL) into computer language that the DIVWAG Model understands. In so doing, the processor dumps a printout of all cards in the deck which permits a final check on both constructive and logic errors prior to processing the data through the Period Processor.

(2) Responsibilities and procedures for the DSL COMPILE are similar to those of the EDIT, except as follows:

(a) The EDIT control deck is replaced by the Orders Input control deck, Figure A-3. Note that the DSL COMPILE deck differs in that it creates a dump tape which may be used to reload the data file.

(b) The work request form is filled out as shown in Figure A-4. Entries are self-explanatory except for Items 12 through 18. These entries are crucial and emphasize the criticality of meticulous records-keeping procedures. To complete these blocks, the Control Team Programmer consults with the Model Maintenance Team for the disk pack number to be placed in the first row of column 12. If the data file must be reloaded, the Control Team Programmer checks his file for the tape number of the previous period dump tape. This step is crucial. If an incorrect dump tape number is used, the program will execute, and the discontinuity will not be evident without a detailed technical review. The dump tape number is inserted in the second row of column 12, and its label is entered in the second row of column 18. The Control Team Programmer completes the third row of columns 13, 14, 15, and 16 as shown in Figure A-4. On the third row of column 17 place the Julian retention date of the start of period tape that will be created by the Orders Input Processor. On the third row of column 18 enter the label desired for the start of period tape. This label is affixed to the physical reel of tape and, along with its reel number, is the identification means for the output of this phase of the computer processing.

(3) When the finished job is returned to the facility, logged, and administratively processed as was the EDIT job, the DSL deck and the COMPILE printout are delivered to the Chief Controller for error analysis and correction.

(4) Error analysis and correction proceed as follows.

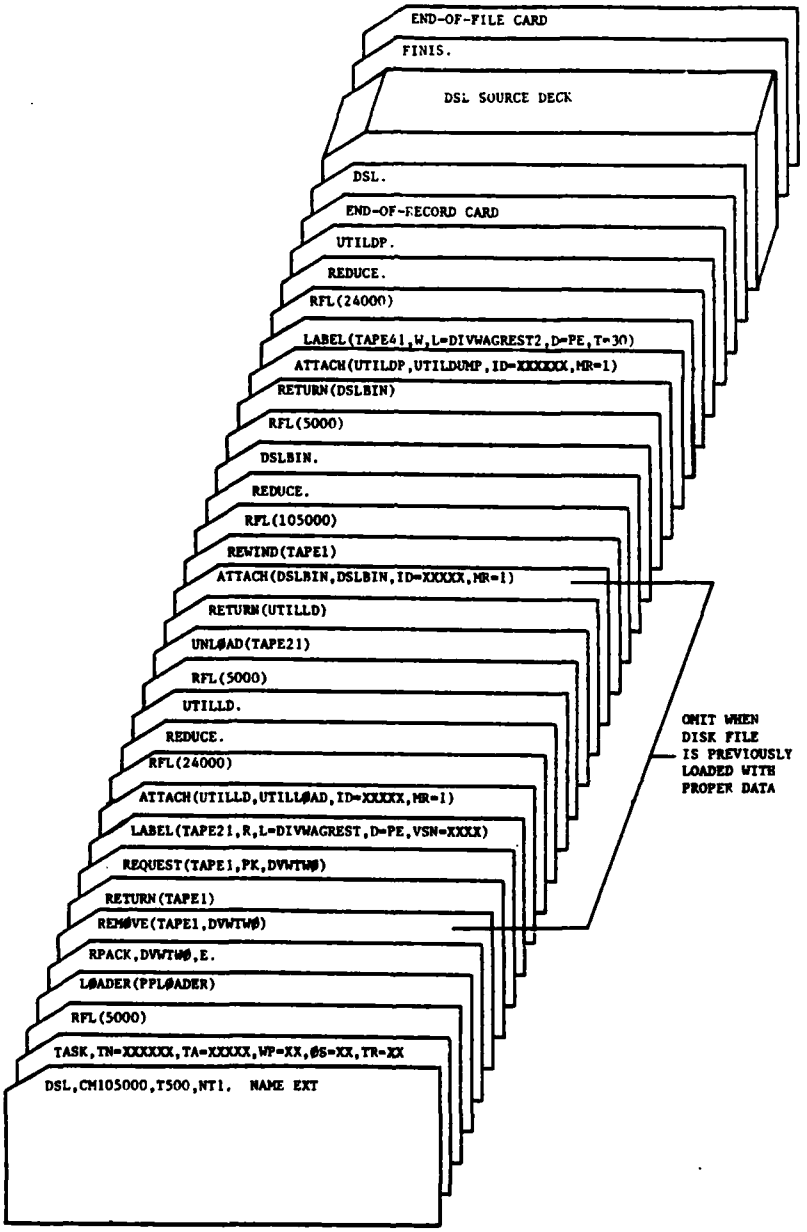
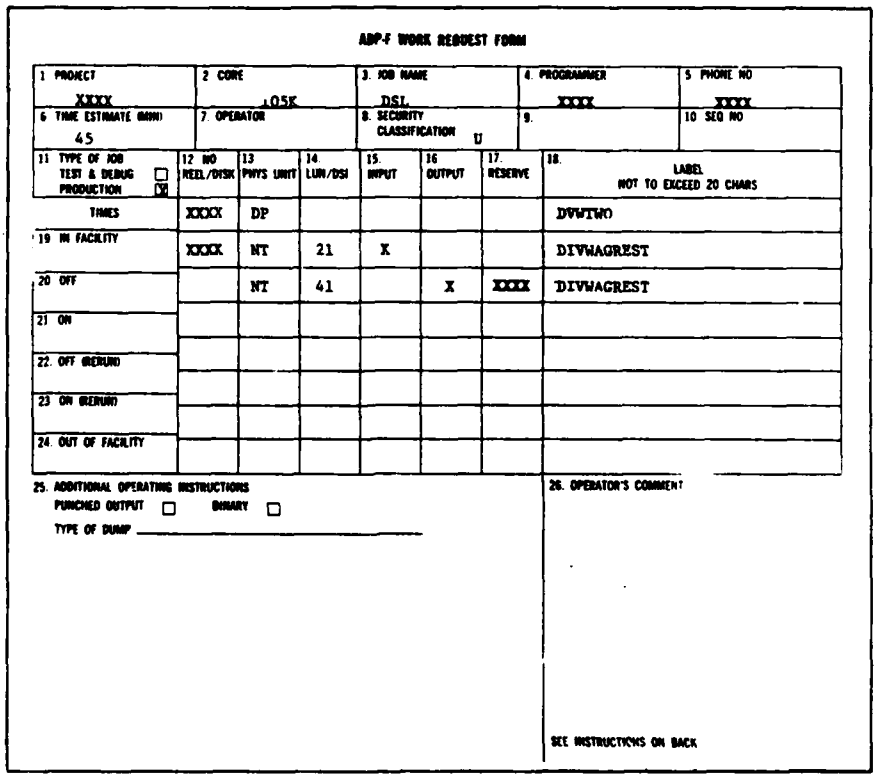


Figure A-3. DSL COMPILE Orders Input Processor Deck Assembly



ADP-F WORK REQUEST FORM

1 PROJECT	2 CORE	3. JOB NAME	4. PROGRAMMER	5 PHONE NO
XXXX	105K	DSL	XXXX	XXXX
6 TIME ESTIMATE (MIN)	**7. OPERATOR**	**8. SECURITY CLASSIFICATION**	**9.**	**10 SEQ NO**
45		U		

11 TYPE OF JOB	12 NO REEL/DISK	13 PHYS UNIT	14. LUN/DSI	15. INPUT	16 OUTPUT	17. RESERVE	18. LABEL NOT TO EXCEED 20 CHARS
TEST & DEBUG ☐ PRODUCTION ☒							
TIMES	XXXX	DP					DVWTWO
19 IN FACILITY	XXXX	NT	21	X			DIVWAGREST
20 OFF		NT	41		X	XXXX	DIVWAGREST
21 ON							
22. OFF (RERUN)							
23 ON (RERUN)							
24. OUT OF FACILITY							

25. ADDITIONAL OPERATING INSTRUCTIONS
PUNCHED OUTPUT ☐ BINARY ☐
TYPE OF DUMP _____

26. OPERATOR'S COMMENT

SEE INSTRUCTIONS ON BACK

Figure A-4. Sample Work Request Form for Orders Input Processor

(a) The DSL COMPILE detects the same type errors as detected by EDIT. It detects errors in logical structure which, if not corrected, either would not be processed by the Period Processor or would result in an unexpected event which could cause unacceptable game period results.

(b) Error correction procedures are the same as prescribed for the DSL EDIT except that the COMPILE must be rerun if any errors are found. The same processing procedures are used for a rerun as for the initial run. If there are no errors, the next step is to load the Operating Instructions if required or proceed to the Period Processor.

d. Operating Instructions Loader. The Operating Instructions composes the last general category of input orders recognized by the Period Processor. The purpose of the Operating Instructions is to provide orders to the Period Processor in the use of sensors, basic decision factors for the application of fire support, allocation of Air Force close air sorties, and introduction of battlefield intelligence from other battlefield sources. Operating Instructions must be prepared for the initial period of a game and may be prepared at the beginning of any succeeding game period. If Operating Instructions are not provided between game periods, the set of instructions from the previous period is maintained.

(1) Responsibility. The Control Team Programmer is responsible for processing the Operating Instructions deck.

(2) General Procedures. Processing of the deck starts with the preparation of the control deck and ends with delivery of the computer printout. It is not necessary or recommended to reload the data file if it already contains the data to be used unless this run immediately follows a Period Report run. The omission of that step saves time and also prevents the possibility of loading the file with the incorrect tape. The data file must be reloaded after a Period Report run.

(3) Preparation of Operating Instructions Loader Control Deck.

(a) The source deck for the Operating Instructions is prepared in accordance with the guidance contained in Appendix C. In addition the data file created by the DSL COMPILE (Orders Input Processor) is input to this task. An acceptable DSL COMPILE should be accomplished before the processing of the Operating Instructions deck.

(b) The control deck assembly consists of the cards shown in Figure A-5.

(4) Preparation of Work Request Form. The Control Team Programmer alerts the messenger that a transport mission is imminent and then prepares two copies of the work request form as shown in Figure A-6, and as follows:

(a) Item 1. Enters code name assigned to the project.

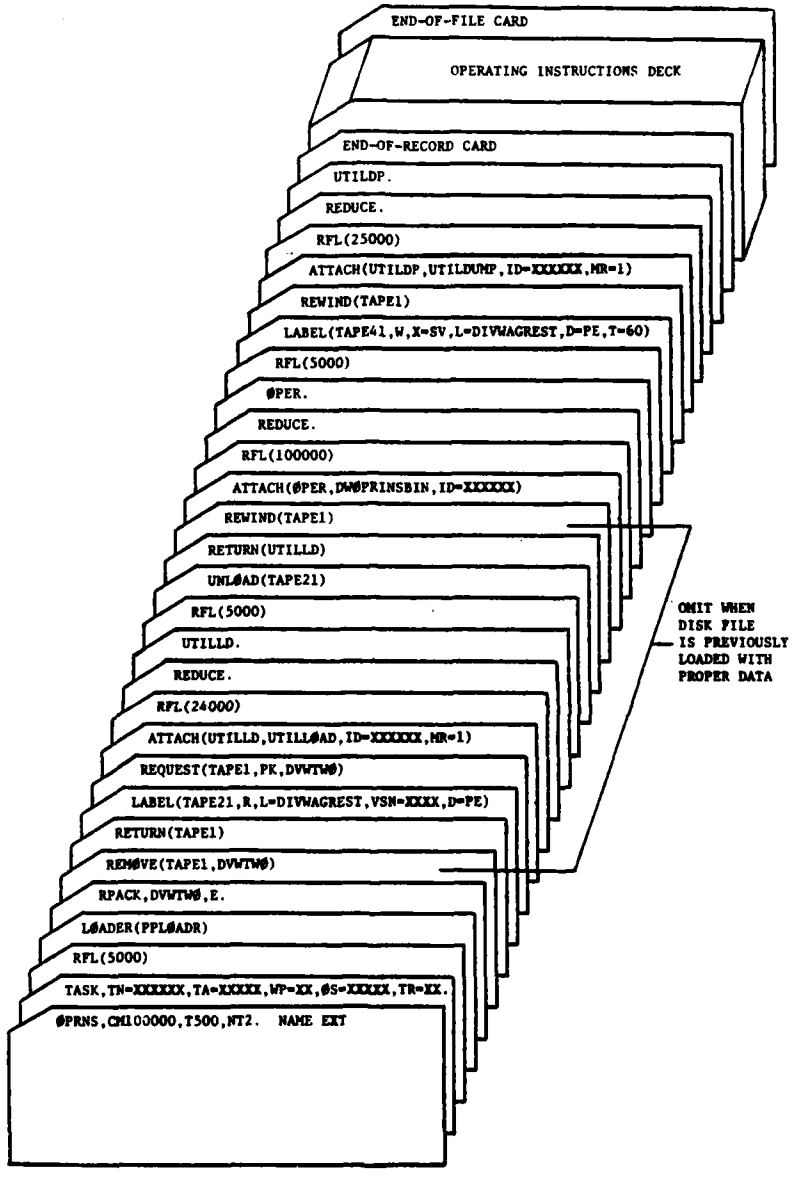
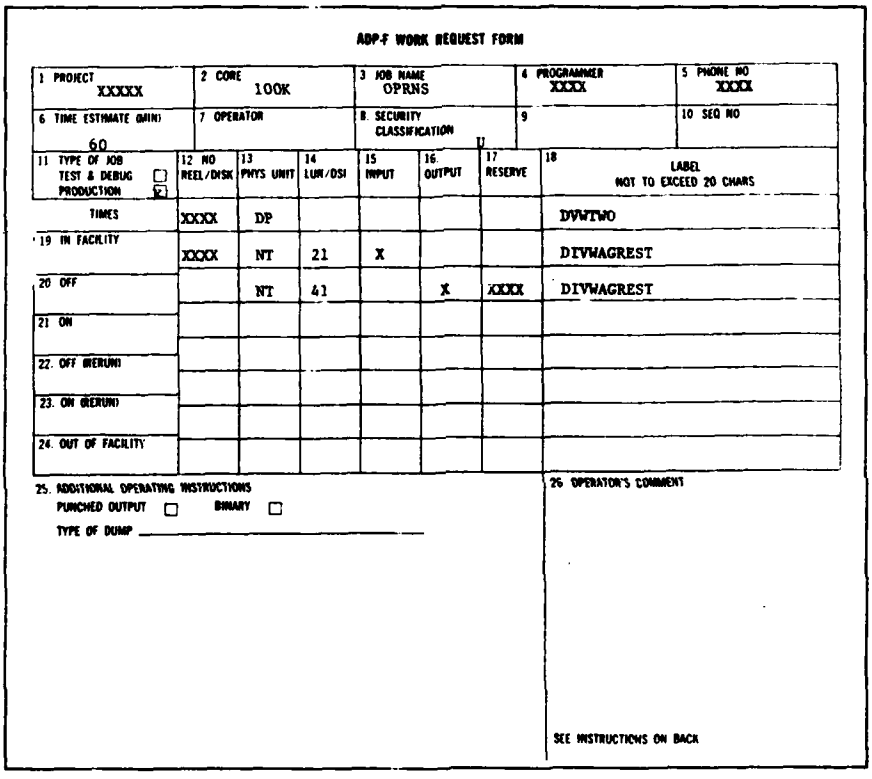


Figure A-5. Operating Instructions Deck Assembly



ADP-F WORK REQUEST FORM

1 PROJECT	2 CORE	3 JOB NAME	4 PROGRAMMER	5 PHONE NO
XXXXX	100K	OPRNS	XXXX	XXXX

6 TIME ESTIMATE (MIN)	7 OPERATOR	8 SECURITY CLASSIFICATION	9	10 SEQ NO
60		U		

11 TYPE OF JOB	12 NO REEL/DISK	13 PHYS UNIT	14 LUN/DSI	15 INPUT	16 OUTPUT	17 RESERVE	18 LABEL NOT TO EXCEED 20 CHARS
TEST & DEBUG ☐ PRODUCTION ☑							
TIMES	XXXX	DP					DVWTWO
19 IN FACILITY	XXXX	NT	21	X			DIVWAGREST
20 OFF		NT	41		X	XXXX	DIVWAGREST
21 ON							
22. OFF (RERUN)							
23. ON (RERUN)							
24. OUT OF FACILITY							

25. ADDITIONAL OPERATING INSTRUCTIONS
PUNCHED OUTPUT ☐ BINARY ☐
TYPE OF DUMP _____

26 OPERATOR'S COMMENT

SEE INSTRUCTIONS ON BACK

Figure A-6. Sample Work Request Form for Operating Instructions

(b) Item 2. Enters computer core requirements for this job.

(c) Item 3. Enters OPRNS.

(d) Item 4. Enters last name of Control Team Programmer.

(e) Item 5. Enters telephone extension of Control Team Programmer.

(f) Item 6. Enters estimate of machine time required.

(g) Items 7, 9, and 10. Leaves blank.

(h) Item 8. Enters U for unclassified.

(i) Item 11. Enters X in production box.

(j) Items 12 through 18. Consults with the Model Maintenance Team for the disk pack number to be placed in the first row of column 12. If the data file must be reloaded the Control Team Programmer checks his file for the tape number of the DSL COMPILE dump tape. This step is crucial. If an incorrect dump tape number is used the program will execute, and the discontinuity will not be evident without a detailed technical review. The dump tape number is inserted in the second row of column 12, and its label is entered in the second row of column 18. The Control Team Programmer completes the third row of columns 13, 14, 15, and 16 as shown in Figure A-6. On the fifth row of column 17 place the Julian retention date of the output tape that will be created by the Operating Instructions Processor. On the third row of column 18 enter the label desired for the start of period tape. This label is affixed to the physical reel of tape and, along with its reel number, is the identification means for the output of this phase of the computer processing.

(k) Items 19 through 24, and 26. Leaves blank.

(l) Item 25. Enters special instructions such as notification of completion and relationship with other runs.

(5) Logging Out of Deck. In the Log Journal the Control Team Programmer enters information from items 1 and 3 of the work request form and, in the Out column, enters the date and time out.

(6) Transportation of Deck to the DPFO. The Control Team Programmer delivers to the messenger the deck and both copies of the prepared work request form. The messenger transports the items to the DPFO, using transportation he summoned at the time he was alerted, and delivers the items to the DPFO Job Control Point. He then returns to the War Game Facility.

(7) Operating Instructions Processing. At this point the DPFO assumes responsibility for logging the job into the facility, establishing a priority for the job, entering the job onto the machine, executing the job, and notifying the Control Team Programmer that the job is completed.

(8) Transportation of Deck to War Game Facility. Upon notification that the job has been completed, the Control Team Programmer instructs the messenger to pick up the job. The messenger summons transportation and proceeds to the DPFO Job Control Point, where he:

(a) Checks the job to see that the work request form, the input deck, and the printout all correspond, and that no materials from other jobs have been included inadvertently.

(b) Signs for the completed job by initialing the original copy of the work request form, which he leaves at the DPFO.

(c) Transports the decks, the printout, and the duplicate copy of the work request form to the War Game Facility and delivers all items to the Control Team Programmer.

(9) Logging In of Deck. In the Log Journal, the Control Team Programmer finds the previous Logging Out entry for this job and in the In column enters the date and time in.

(10) Removal of Control Deck. The Control Team Programmer separates the Operating Instructions deck from the control deck; secures the Operating Instructions deck; and consolidates, secures, and stores the control deck.

(11) Filing of Work Request Form. The Control Team Programmer files the work request form in his file of completed work request forms.

(12) Delivery of the Operating Instructions Deck and the Printout. The Control Team Programmer delivers the Operating Instructions deck and the printout to the Records Controller of the Control Team. This completes the processing of the data through the Operating Instructions Processor.

e. Period Processor. In general, most procedures and functional steps for the Period Processor are similar to or identical to those for processing data through the previous steps, with a few major exceptions or changes. To preclude any ambiguity, each item is listed below with an indication of any changes applicable for the Period Processor.

(1) Responsibility. The Control Team Programmer is responsible for processing the period.

(2) General Procedure. Processing of data through the Period Processor starts with the preparation of control decks and ends with delivery of game period reports and printout.

(3) Run Sequence Technique.

(a) The recommended procedure is to utilize the SCOPE dependency queue feature as illustrated in the following examples. This permits all Period Processor decks and the Period Output Processor deck to be input at once and they will be processed in the devised order. When the TRANF card

is encountered in each job, the next job will be permitted to execute. Refer to the Control Data Corporation SCOPE Reference Manual for a complete explanation of this feature.

(b) If all decks are prepared properly and executed sequentially, the data file should not be reloaded at the beginning of each job for three reasons.

1. The data file already contains the correct data and the time required to reload it--approximately 20 minutes--is wasted.

2. The reel number of the dump tape to be used is not known when the run is submitted.

3. A greater risk of loading the data file from the wrong tape is introduced. Therefore, the utility load control cards (identified by brackets in the figures) should be omitted from the decks when a continuous job sequence is submitted and the identification of TAPE21 should be omitted from the associated work requests. The utility load operation is necessary for a Period Processor restart following an abnormal termination and recommended for the first job in a series.

NOTE: The data file must be reloaded once after the Period Output Processor run prior to any other run.

(4) Preparation of Period Processor Control Decks:

(a) In contrast with the previous processes, there is no source deck for the Period Processor. Instead, the source input for the Processor is the execute program tape produced during either the Orders Input Processing or the loading of Operating Instructions. This execute program tape must be acceptable before period processing can be started.

(b) When the volume of input data is large, computer time limitations may require breaking the game period into increments for processing. The first processing increment is called the Start of Period, and all subsequent increments are called Period Restart. All increments are numbered consecutively inasmuch as the output dump tape from each increment functions as the input source tape for the next increment.

(c) The number of increments required depends on the volume of data processed and priorities at the DPFO. Usually, preparations are made for at least three increments. Each increment requires a separate control deck and run request form.

(d) The control deck assembly for the Start of Period is illustrated in Figure A-7. Only the data card varies. The data card contains four types of information:

- Run identification

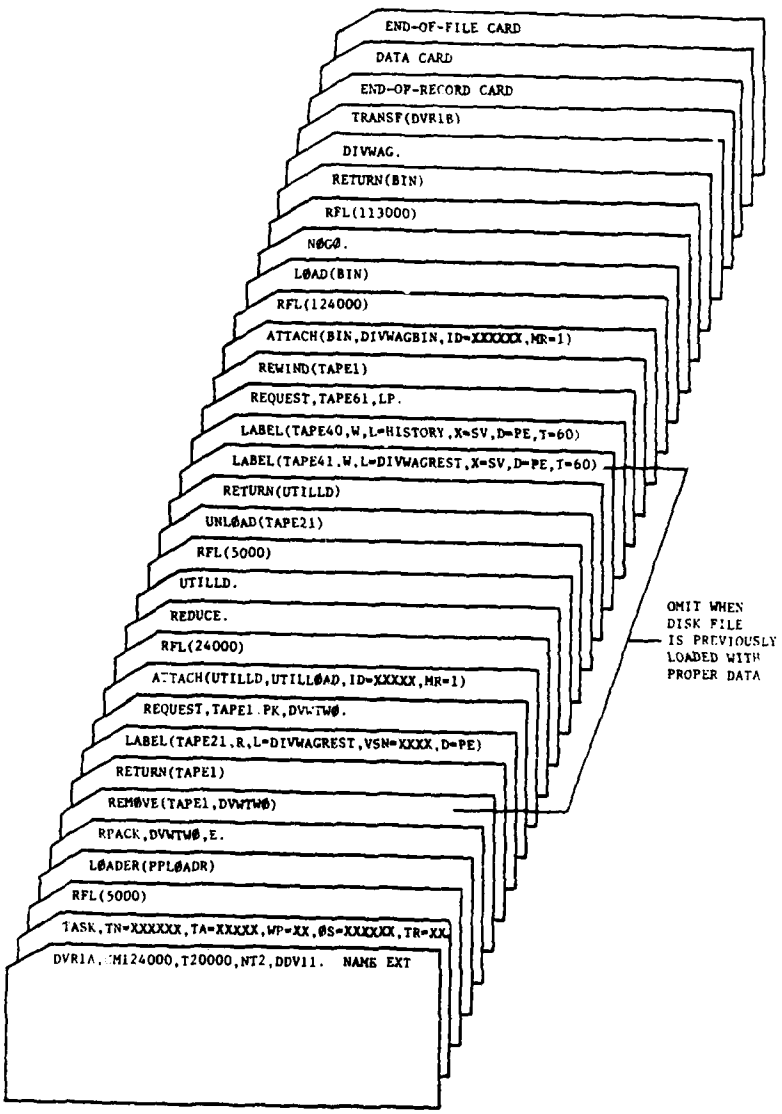
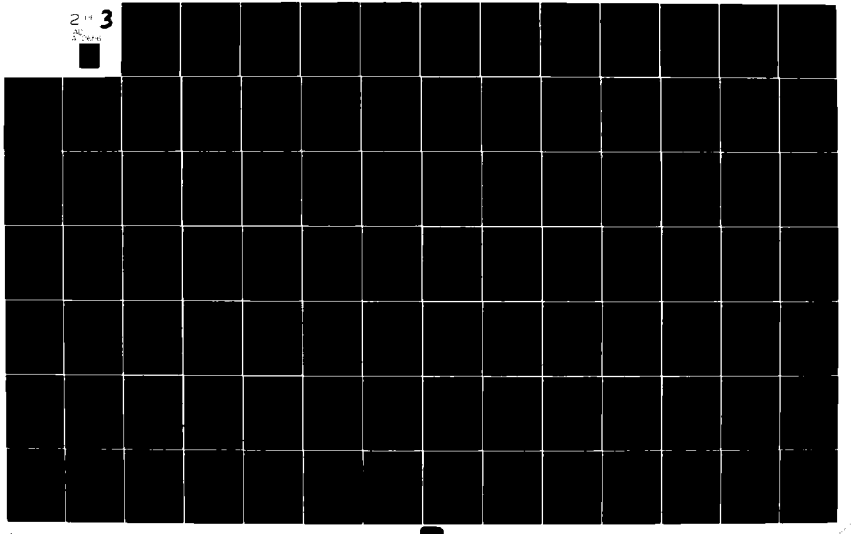


Figure A-7. Period Processor Start of Period Deck Assembly

AD-A112 656 ARMY COMBINED ARMS COMBAT DEVELOPMENTS ACTIVITY FORT--ETC F/G 15/7
DIVWAG MODEL DOCUMENTATION. VOLUME III. PLANNER/USER MANUAL.(U)
JUL 76
UNCLASSIFIED CACDA-TR-8-76-VOL-3 NL



- Run time in minutes
- Restart time in minutes
- Optional print switches.

The data card is prepared by the Control Team Programmer after coordination with the Control and Model Maintenance Teams. The print switches which produce technical printout in the Period Processor Output will be turned off (i.e., entered as zero) unless the Model Maintenance Team requests any or all of the four switches turned on (i.e., set to one). Start of Period data card entries are as follows:

Start of Period Card

Beginning Card Column	Ending Card Column	Number of Characters	Data Element Description
1	4	4	Run identification code may be any four nonblank characters except "REST"
11	15	5	Computer running time cutoff in wall clock minutes
16	20	5	Restart dump interval in wall clock minutes
21	24	4	Optional print switches

(e) The control deck assembly for Period Restart is illustrated in Figure A-8. Only the restart data card varies. The restart data card content and its preparation are identical to those for the data card in the Start of Period deck, except the card entry starts with restart. Restart data card entries are as follows:

Restart Period Card

Beginning Card Column	Ending Card Column	Number of Characters	Data Element Description
1	4	4	Enter "REST"
11	15	5	Computer running time cutoff in wall clock minutes

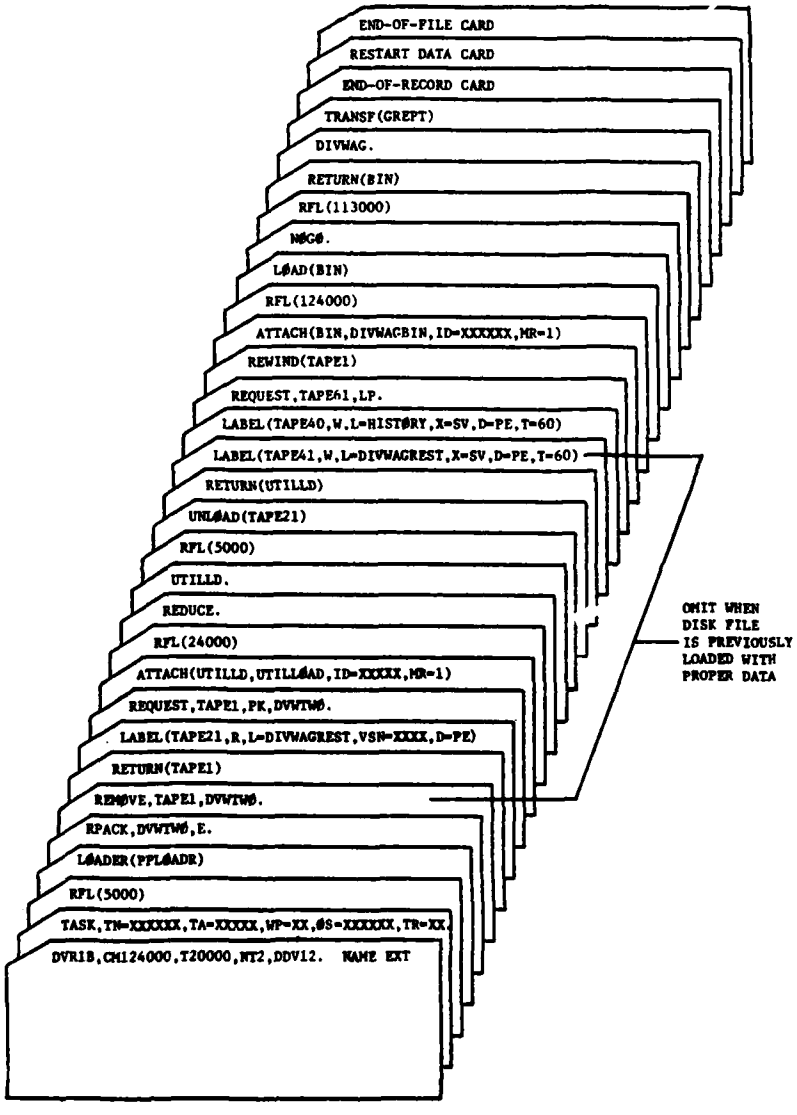


Figure A-8. Period Processor Restart Deck Assembly

Beginning Card Column	Ending Card Column	Number of Characters	Data Element Description
16	20	5	Restart dump interval in wall clock minutes
21	24	4	Optional print switches

(f) All control decks for all period restarts are identical, except the first card and the TRANSF card hence the additional decks required may be duplicated from the original.

(5) Preparation of Period Report Control Deck:

(a) As with the Period Processor, there is no source deck for the Period Output Processor. Instead, the source input for the Period Output Processor is the dump tape produced by the last DIVRUN of the Period Processor.

(b) The control deck assembly for the Period Report is illustrated in Figure A-9. Only the optional header card varies. The header card carries the identification title, which will appear at the top of each page of the Period Output Reports; it may be any length up to 80 characters. The header card is prepared by the Control Team Programmer after coordination with the Control Team. A sample header card entry is as follows:

WAGCAP TEST GAME 1 MOBILE DEFENSE PERIOD 2

(6) Preparation of Period Processor Work Request Forms. A separate work request form is required for each Period Processor deck being submitted to the DPFO. See Figures A-10 and A-11.

(a) Item 1. Enter code name assigned to the project.

(b) Item 2. Enter computer core requirements for this job.

(c) Item 3:

1. For Start of Period, enter the job name corresponding to the first entry on the first control card.

2. For Period Restart, enter the job name for each restart deck, as required for the number of decks being submitted. These must correspond to the first entry on the first control card of the deck to be submitted.

(d) Item 4. Enter last name of Control Team Programmer.

(e) Item 5. Enter telephone extension of Control Team Programmer.

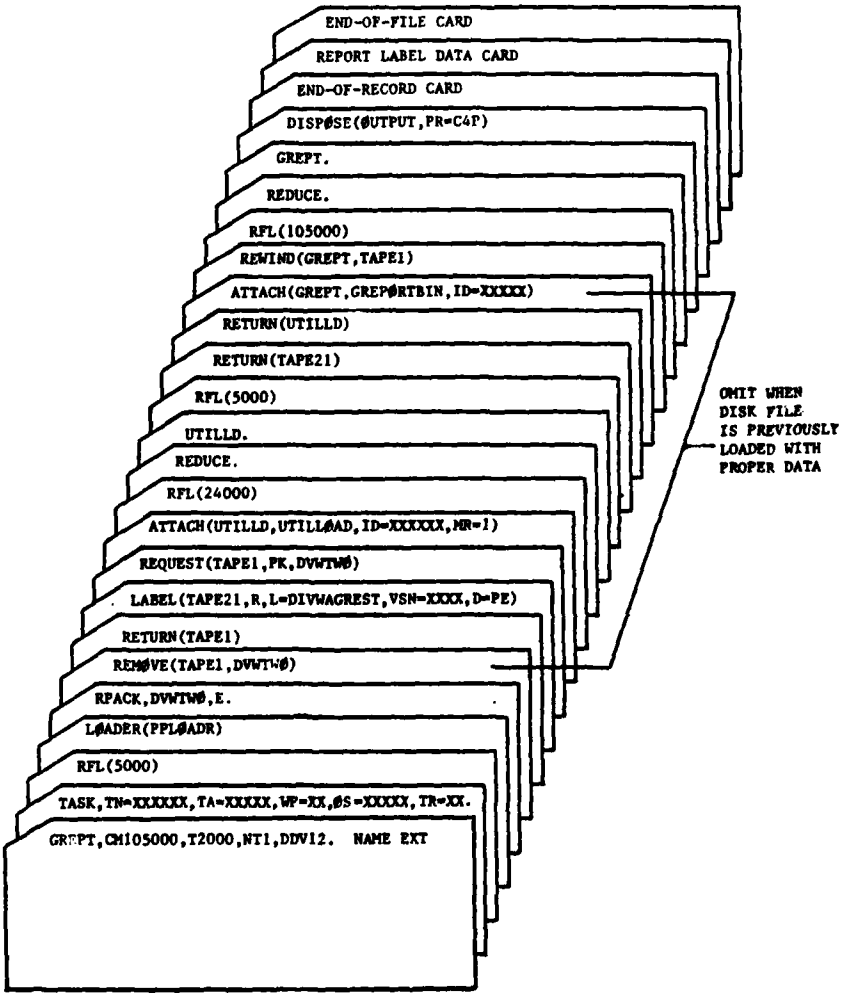
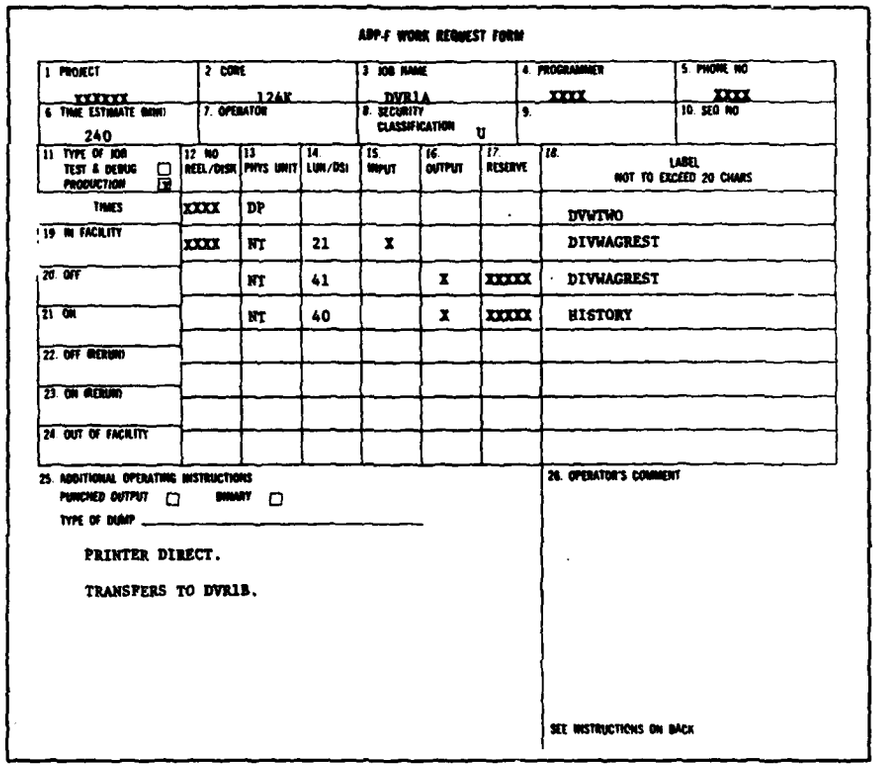


Figure A-9. Period Report Deck Assembly



ADP-F WORK REQUEST FORM

1 PROJECT	2 CORE	3 JOB NAME	4 PROGRAMMER	5 PHONE NO
XXXXXX	124K	DVR1A	XXXX	XXXX
6 TIME ESTIMATE (MIN)	7. OPERATOR	8. SECURITY CLASSIFICATION	9.	10. SEQ NO
240		U		

11 TYPE OF JOB	12 NO REEL/DISK	13 PHYS UNIT	14. LUN/DS)	15. INPUT	16. OUTPUT	17. RESERVE	18. LABEL NOT TO EXCEED 20 CHARS
TEST & DEBUG ☐ PRODUCTION ☒							
TIMES	XXXX	DP					DVWTWO
19 IN FACILITY	XXXX	NT	21	X			DIVWAGREST
20. OFF		NT	41		X	XXXX	DIVWAGREST
21 ON		NT	40		X	XXXX	HISTORY
22. OFF (RERUN)							
23. ON (RERUN)							
24 OUT OF FACILITY							

25. ADDITIONAL OPERATING INSTRUCTIONS

PUNCHED OUTPUT ☐ BINARY ☐

TYPE OF DUMP _____

PRINTER DIRECT.

TRANSFERS TO DVR1B.

26. OPERATOR'S COMMENT

SEE INSTRUCTIONS ON BACK

Figure A-10. Sample Work Request Form for Period Processor Start of Period

ADP-F WORK REQUEST FORM

1 PROJECT	2 CORE	3 JOB NAME	4 PROGRAMMER	5 PHONE NO
XXXXXX	124K	DVR1B	XXXX	XXXX
6 TIME ESTIMATE (MIN)	**7 OPERATOR**	**8 SECURITY CLASSIFICATION**	**9**	**10 SEQ NO**
240		U		

11 TYPE OF JOB	12 NO REEL/DISK	13 PHYS UNIT	14 LUN/DSI	15 INPUT	16 OUTPUT	17 RESERVE	18 LABEL (NOT TO EXCEED 20 CHARS)
TEST & DEBUG ☐ PRODUCTION ☒							
TIMES	XXXX	DP					DVWTWO
19 IN FACILITY	XXXX	NT	21	X			DIVWAGREST
20 OFF		NT	41		X	XXXX	DIVWAGREST
21 ON		NT	40		X	XXXX	HISTORY
22 OFF (RERUN)							
23 ON (RERUN)							
24 OUT OF FACILITY							

25 ADDITIONAL OPERATING INSTRUCTIONS

PUNCHED OUTPUT ☐ BINARY ☐

TYPE OF DUMP _____

PRINTER DIRECT.

TRANSFERS TO GREPT.

26. OPERATOR'S COMMENT

SEE INSTRUCTIONS ON BACK

Figure A-11. Sample Work Request Form for Period Processor Restart

(f) Item 6. Enter estimate of machine time required.

(g) Items 7, 9, and 10. Leave blank.

(h) Item 8. Enter U for unclassified.

(i) Item 11. Enter X in production box.

(j) Items 12 through 18. Consult with the Model Maintenance Team for the disk pack number to be placed in the first row of column 12. If the data file must be reloaded the Control Team Programmer checks his file for the tape number of the Orders Input Processor Start of Period tape. This tape was created on NT 41 (see Figure A-6, last row). This step is crucial. If an incorrect tape number is used the program will execute, and the discontinuity will not be evident without a detailed technical review. The Orders Input Processor Start of Period tape number is inserted in the second row of column 12, and its label is entered in the second row of column 18 for the Start of Period only. For subsequent increments of the same period the second row of column 12 is left blank, and the second row of column 18 will contain the label of the dump tape of the previous increment. The Control Team Programmer completes the third and fourth rows of columns 13, 14, 15, and 16 as shown in Figures A-10 and A-11. On the third and fourth rows of column 17 place the Julian retention date of each tape that will be created by the Period Processor. Enter on each row of column 18 the label desired for each tape. These labels are affixed to each physical reel of tape and, along with its reel number, is the identification means for the output of this phase of the computer processing. The tapes produced by the Period Processor are as follows:

- NT 40 - the period history records for postgame analysis
- NT 41 - the end of period (or increment) dump of all data files

A dump tape is created at the end of each time increment specified in the restart time in the data card. A dump tape plus an exact copy of the dump tape is created at the end of each complete increment. The careful logging of tape numbers and labels is imperative because all tapes are indistinguishable to the system.

(k) Items 19 through 24, and 26. Leave blank.

(l) Item 25. Enter special instructions such as notification of completion and relationship with other runs.

(7) Logging Out of Decks. In the Log Journal the Control Team Programmer enters information from items 1 and 3 of the work request form and in the Out column, enters the date and time out.

(8) Preparation of Period Report Work Request Form. A separate work request for the Period Report is in addition to the Period Processor work requests being submitted to the DPFO. See Figure A-12.

(a) Item 1. Enter code name assigned to the project.

(b) Item 2. Enter computer core requirements for this job.

(c) Item 3. Enter GREPT.

(d) Item 4. Enter last name of Control Team Programmer.

(e) Item 5. Enter telephone extension of Control Team Programmer.

(f) Item 6. Enter estimate of machine time required.

(g) Items 7, 9, and 10. Leave blank.

(h) Item 8. Enter U for unclassified.

(i) Item 11. Enter X in production box.

(j) Items 12 through 18. Consult with the Model Maintenance Team for the disk pack numbers to be placed in the first row of column 12. If the data file must be reloaded, the input tape on NT 21 is the dump tape created on NT 41 from the last DIVRUN in the series.

(k) Items 19 through 24, and 26. Leave blank.

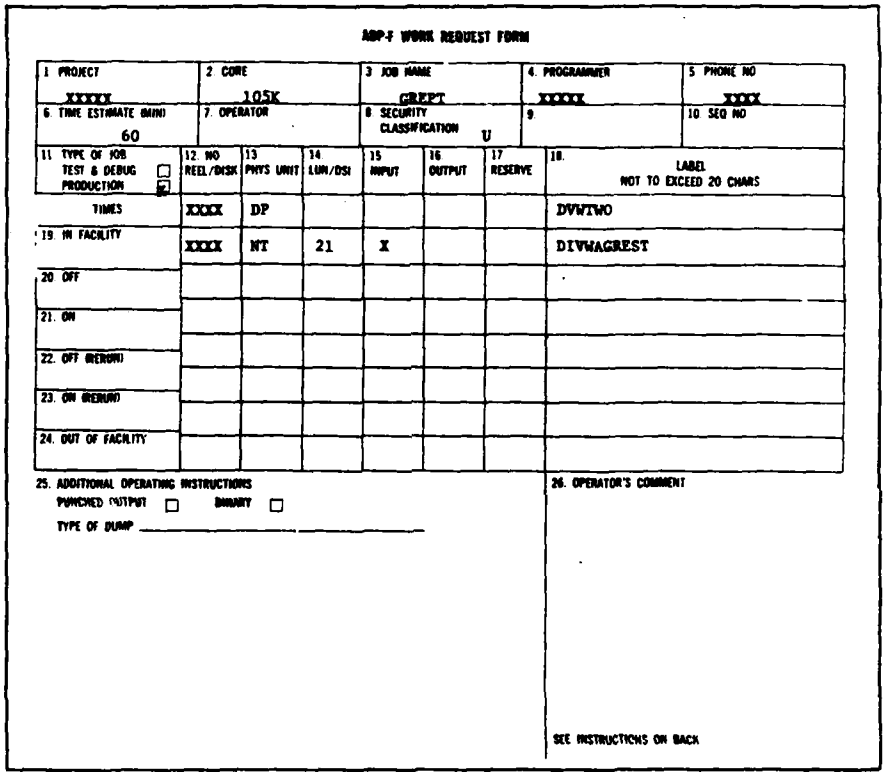
(l) Item 25. Enter special instructions such as notification of completion and relationship with other runs.

(9) Logging Out of Deck. In the Log Journal the Control Team Programmer enters information from items 1 and 3 of the work request form and in the Out column, enters the date and time.

(10) Transportation of Deck to the DPFO. The Control Team Programmer delivers to the messenger the Period and Period Processor decks and both copies of the prepared work request forms. The messenger transports the items to the DPFO, using transportation he summoned at the time he was alerted, and delivers the items to the DPFO Job Control Point. He then returns to the War Game Facility.

(11) Period Processing. At this point the DPFO assumes responsibility for logging the job into the facility, establishing a priority for the job, entering the job onto the machine, executing the job, and notifying the Control Team Programmer that the job is completed.

(12) Transportation of Deck to War Game Facility. Upon notification that the job has been completed, the Control Team Programmer instructs the



ADP-F WORK REQUEST FORM

1 PROJECT	2 CORE	3 JOB NAME	4. PROGRAMMER	5 PHONE NO
XXXXX	105K	GREPT	XXXXX	XXXX
6 TIME ESTIMATE (MIN)	7 OPERATOR	8 SECURITY CLASSIFICATION	9	10 SEQ NO
60		U		

11 TYPE OF JOB	12 NO REEL/DISK	13 PHYS UNIT	14 LUN/DSI	15 INPUT	16 OUTPUT	17 RESERVE	18. LABEL NOT TO EXCEED 20 CHARS
TEST & DEBUG ☐							
PRODUCTION ☑							
TIMES	XXXX	DP					DVWTWO
19. IN FACILITY	XXXX	NT	21	X			DIVWAGREST
20 OFF							
21. ON							
22. OFF (RERUN)							
23. ON (RERUN)							
24. OUT OF FACILITY							

25. ADDITIONAL OPERATING INSTRUCTIONS

PUNCHED OUTPUT ☐ BINARY ☐

TYPE OF DUMP _____

26. OPERATOR'S COMMENT

SEE INSTRUCTIONS ON BACK

Figure A-12. Sample Work Request Form for Period Report

messenger to pick up the job. The messenger summons transportation and proceeds to the DPFO Job Control Point, where he:

(a) Checks the job to see that the work request form, the Period Processor deck or decks, and the printout all correspond, and that no materials from other jobs have been included inadvertently.

(b) Signs for the completed job by initialing the original copy of the work request form, which he leaves at the DPFO.

(c) Transports the Period and Period Output Processor deck or decks, the printout, and the duplicate copy of the work request form to the War Game Facility and delivers all items to the Control Team Programmer.

(13) Logging In of Deck. In the Log Journal, the Control Team Programmer finds the previous Logging Out entry for this job, and in the In column enters the date and time in.

(14) Filing of Work Request Form. The Control Team Programmer files the work request form in his file of completed work request forms.

(15) Separation of Period Output Reports. The Period Output Reports will be printed on four-part paper by the computer. The Control Team Programmer, after review of the output, will instruct the messenger to take the Period Reports to the Data Processing Facility at Rucker Hall where the computer output is decollated. The messenger will wait until the paper is decollated and then return to the War Game Facility.

(16) Delivery of Printout. The Control Team Programmer delivers the technical printout and one copy of the Period Output Reports to the Model Maintenance Team. He delivers the remaining copies of the Period Output Reports to the Chief Controller of the Control Team. This procedure completes the processing of the data through the Period Processor.

f. Summary. Successful completion of a Period Processor computer run ends the game period cycle operations. Clearly, success can only be determined after a comprehensive review and analysis of the Period Reports, the subject of the next paragraph, to which the user is referred to evaluate the success of the computer interface for the period.

3. PERIOD OUTPUT. The Period Processor produces a printout for technical diagnostic purposes and force reports on game status for use of the gaming staff. Review and analysis of these two types of output are discussed separately.

a. Technical Output:

(1) The primary purpose of this output is to provide diagnostic data for the analyst to determine any technical errors occurred during

the operation of the DIVWAG Model Period Processor. Those data are explained in Volume II, Section VIII, Chapter 4.

(2) The Model Maintenance Team is responsible for conducting the analysis for technical acceptability of the game period processed. They will task the gaming group for any assistance required as a result of any technical errors or anomalies discovered.

b. Technical Output Analysis Procedures:

(1) The system analyst reviews the printout with regard to the following three areas of interest:

(a) Reasonableness of time ranges (game time at the end of the run, job compute time, and channel time).

(b) Legitimacy of termination.

(c) Interpretation of printed diagnostic statements.

(2) The system analyst determines the nature of the correction to be made and notes this on the printout, indicating specifics of the correction when applicable.

(3) The system analyst initiates correction of errors in accordance with procedures specified in Volume II, Section VIII, Chapter 4.

(4) At the completion of the analysis, the Chief, Model Maintenance Team, advises the Chief Controller as to the results of the analysis and the technical validity of the results.

(a) If he indicates that the results are technically invalid, he will indicate the reasons therefor, the corrective action which must be taken to give valid results, and the probable implications of proceeding with the present results.

(b) If he indicates that the results are technically valid, he will recommend a basis for proceeding and indicate any corrective action that may be desired for improving the processing.

c. Period Output Reports. The Period Output Processor provides the following reports on game status for each game period processed. Both Blue and Red reports are provided.

- Intelligence Report
- Force Status Report
- Force Period Planning Report
- Barrier and Facility Report

(1) Intelligence Report. An intelligence report is provided for each division size force gamed in the simulation. Figure A-13 is an example of such a report. The following discussion relates to that figure and the circled numbers thereon.

(a) On all reports the first four items are a standard heading. The game identifier (1) is an optional legend that can be input during processing and will appear on all pages of all reports. If the optional input card in the GREPORTS deck is not present, then the legend DIVWAG WAR GAME is supplied by the program. The date and time (2) are the real time that the reports were prepared; that is, the wall clock time at the end of the processing. Page numbers (3) appear as indicated. The game period simulated (4) gives the beginning time and ending time of the actual game period simulated. The beginning of a game is always DAY 1 HR 0 MIN 0.

(b) The report title (5) identifies the force, Blue or Red, receiving the report and an index (1, 2, or 3) identifying the specific division force. Four intelligence files are maintained, one for Blue and three for Red. The intelligence index (6) is assigned at the time the target is first reported and is a permanent part of the report through all parts of the model. The last three digits of the intelligence index (6) indicate the sequence number assigned that particular report. The first two digits in a five-digit intelligence index, or the first three digits in a six-digit intelligence index, will identify the unit, by Unit Status File record number, acquiring the intelligence. The intelligence indices containing more than six digits are internally generated and do not provide the information as explained above. If new information is reported that is deemed to correspond to an existing report the information is consolidated into the existing report retaining the existing intelligence index. The information items are estimated location (7), size (8), activity (9), type (10), and direction of movement (11); all are self-explanatory. These information items are developed by the Intelligence and Control Model, and a full understanding of that model is necessary for interpretation. The report does not make subtle distinctions such as battery or troop in lieu of company for artillery or cavalry units. The time of last collection (12) and the number of sightings (13) indicate how often and how long ago the unit was reported to the division.

(2) Force Status Report. The Force Status Report is made up of three parts, in addition to the standard headings (1)-(4) discussed above. They are force status at end of the period, activity report for the period, and ground movements and supporting fires during the period. See Figure A-14.

(a) That part of the report which contains the unit's status at the end of the period contains the unit organization and current situation (5). Included therein is the unit identity, both UID and UTD; its location; its next senior headquarters; its directional heading; and the unit's dimensions. The personnel status (6) gives the on-hand strength and the percent of authorized. The material status (7) provides the equipment by item code number, the amount of each in the unit, the amount in unit bulk load, the

(1) DIVWAG WAR GAME (2) DATE: 05/03/72 TIME: 06:49:56 (3) PAGE 1

(4) BEGINNING TIME DAY 1 HR 19 MIN 30
ENDING TIME DAY 2 HR 4 MIN 0

(5) ********** RED 2 INTELLIGENCE REPORT **********

(6) INDEX	(7) EST. LOCATION X	Y	(8) EST. SIZE	(9) EST. ACTIVITY	(10) EST. TYPE	(11) DIRECTION OF MOVEMENT	(12) TIME LAST DETECTED DAY	HOUR	MINUTE	(13) ATTRIBUTED SIGHTINGS
753884	126370	98443	CO PLUS	WITHDRAW	REINF TF	WSW	1	20	48	13
762881	125037	92237	BN	DEFEND	REINF TF	E	1	19	30	1
762882	123833	95467	BN	DEFEND	REINF TF	E	1	19	30	1
762825	128445	92080	CO PLUS	DEFEND	REINF TF	ENE	2	2	38	42
777814	127599	85499	BN	DEFEND	MECH INF	ENE	2	2	45	13
777848	122932	97787	PLT PLUS	DEFEND	MECH INF	E	1	19	30	1
777854	126376	94197	BN	MOVING	REINF TF	W	1	20	9	1
777865	127833	85139	CO	DEFEND	REINF TF	ENE	1	20	35	33
777874	125674	87448	PLT	WITHDRAW	MECH INF	WSW	1	20	21	1
777889	125892	95154	BN	MOVING	REINF TF	SW	1	20	32	1
823838	129946	82198	CO PLUS	DEFEND	REINF TF	ENE	1	20	35	4
869827	124652	100035	BN	MOVING	REINF TF	WSW	1	20	39	1
869829	124963	97733	BN	MOVING	REINF TF	WSW	1	20	40	1
869836	123701	99347	BN	MOVING	REINF TF	WSW	1	20	52	1
2020882	123045	93212	BN PLUS	MOVING	REINF TF	WSW	1	21	56	1
2020883	122918	93057	BN PLUS	MOVING	REINF TF	WSW	1	21	56	1
2020884	121888	91171	BN PLUS	MOVING	REINF TF	WSW	1	22	4	1
2020885	121184	91364	BN PLUS	MOVING	REINF TF	WSW	1	22	4	1
2020886	121853	91288	BN PLUS	MOVING	REINF TF	WSW	1	22	11	1
2020887	121443	91474	BN PLUS	MOVING	REINF TF	WSW	1	22	11	1
2020888	121248	91476	BN PLUS	MOVING	REINF TF	WSW	1	22	12	1
2020889	121353	91638	BN PLUS	MOVING	REINF TF	WSW	1	22	12	1

Figure A-13. Example Intelligence Report

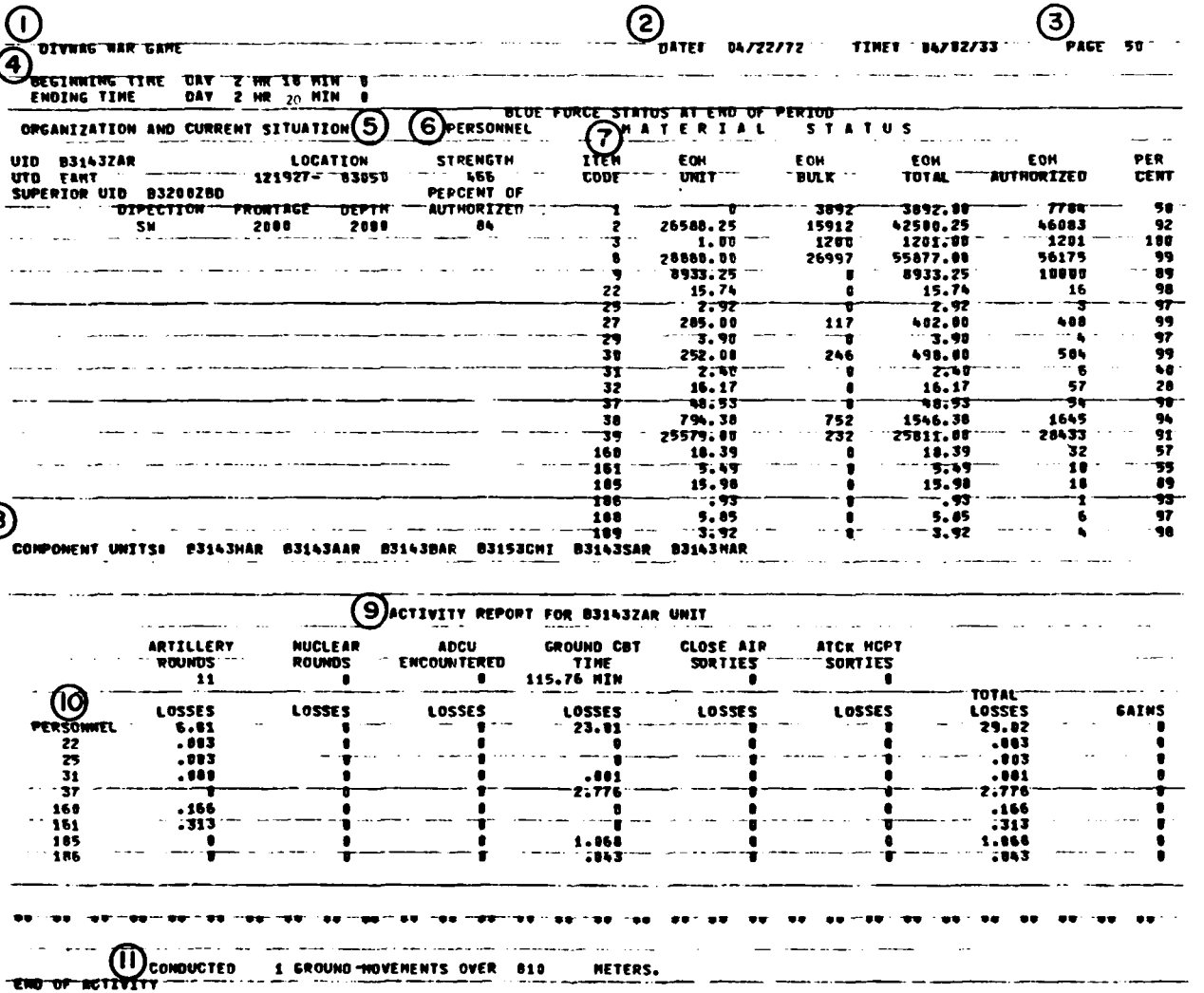


Figure A-14. Example Force Status Report

total, the amount authorized, and the percent of authorized on hand. Finally this portion of the report identifies the unit's subordinates (8).

(b) The period activity portion of the report (9) describes, in a general sense, what really happened to the unit during the period in the sense of incoming artillery rounds received, incoming nuclear rounds, air defense capable units (ADCU) encountered, time spent in ground combat, and air sorties flown against the unit by either close air or attack helicopter. The report lists (10) the number of personnel and major end items of equipment lost to:

- Artillery conventional fires
- Nuclear weapons
- Air defense capable units
- Ground combat
- High-performance aircraft
- Attack helicopters

In addition, the total losses of personnel and major end items and any gains of personnel or major end items during the period are listed.

(c) The final portion of the Force Status Report (11) reports the activities conducted by the unit. In the example at Figure A-14, the number of ground movements and the distance covered were reported. The following activities, if performed by a unit, will be reported.

- Number of artillery rounds fired on x number of TACFIRE missions
- Number of artillery rounds fired on x number of DSL fire missions
- Number of nuclear rounds fired
- Number of sorties flown against x number of acquired targets
- Number of sorties flown against x number of DSL targets
- Number of obstacles encountered and delay time in minutes
- Number of engineer tasks completed
- Number of reconnaissance sorties flown
- Number of enemy aircraft fired on
- Number of escort and lift aircraft provided for x number of airmobile operations
- Number of airmobile movements conducted over x number of meters.

(3) Force Period Planning Report. The Force Period Planning Report serves two functions. One is to provide a convenient list of units in task organization order for map plotting. The second function is to provide a numerical and alphabetical cross reference index to the Force Status Report. Figure A-15 is an example of the Force Period Planning Report. The standard headings (1)-(4) also appear on this report. The report title (5) identifies the force covered by the report.

(a) The task organization section (6) includes:

1. The UID and UTD (7) of each unit.

2. The nonresolution accounting unit indicator (8) or the resolution unit indicator (9). The model makes use of the unit's coordinates to determine whether a unit is a resolution or a nonresolution unit. Thus, nonresolution units have zeros for their x and y coordinates (8), whereas resolution units have nonzero entries for their x and y coordinates (9).

3. The page number (10) in the Force Status Report on which the unit can be found.

4. The Unit Status File record number (11). All units, both resolution and nonresolution, have a record in the Unit Status File. The Unit Status File record number is used by Model Maintenance Team personnel for tracing technical errors.

(b) The cross reference index (12) is provided for ease of locating a particular unit's Force Status Report. The collating sequence is alphabetical followed by numerical; thus, in any character position of the UID, the letters A through Z will precede the numbers 0 through 9. The grouping of UIDs will have all UIDs that only vary in one character position together. Within this group, the UID will be listed according to the collating sequence, with all letters in the order A to Z followed by the numbers in the order 0 to 9. The sorting sequence is right to left so that every UID whose second character from the left is the same will appear together. Within the group every UID whose third character from the left is the same will appear together and similarly for the fourth through eighth characters; thus, the first UID would be B or R followed by seven letters A, and the last UID would be B or R followed by seven nines, if these UIDs were used in the force.

(4) Barrier and Facility Report. This report provides a comprehensive listing of barriers and facilities loaded for the game, and their known status at the end of any given game period. Figure A-16 is an example of part of such a report. The standard headings (1)-(4) are included.

(a) Each barrier and each facility carries its own unique mnemonic (5) in which the first three characters designate the type and the last three designate a unique facility of that type or a unique segment of that type barrier. Each also carries its own file number in the barrier/facility file (6).

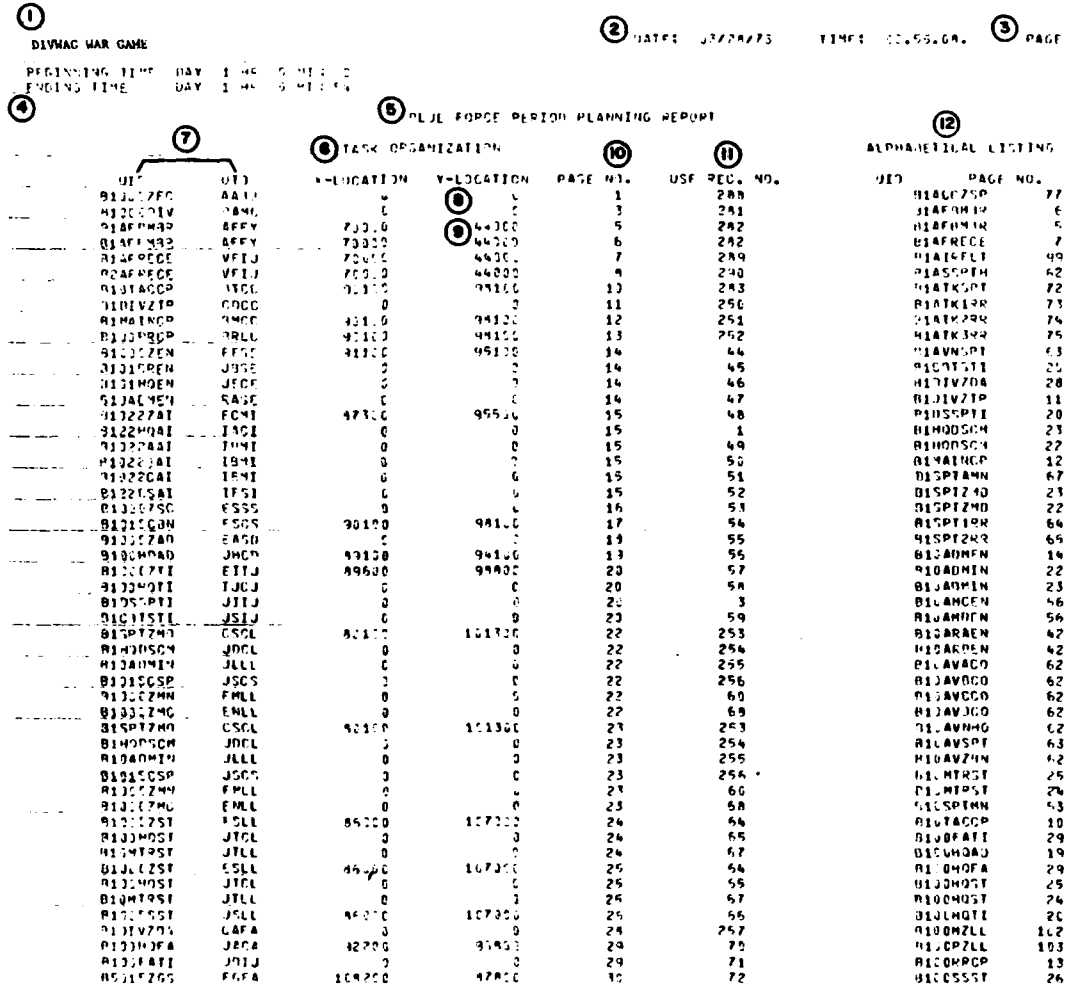
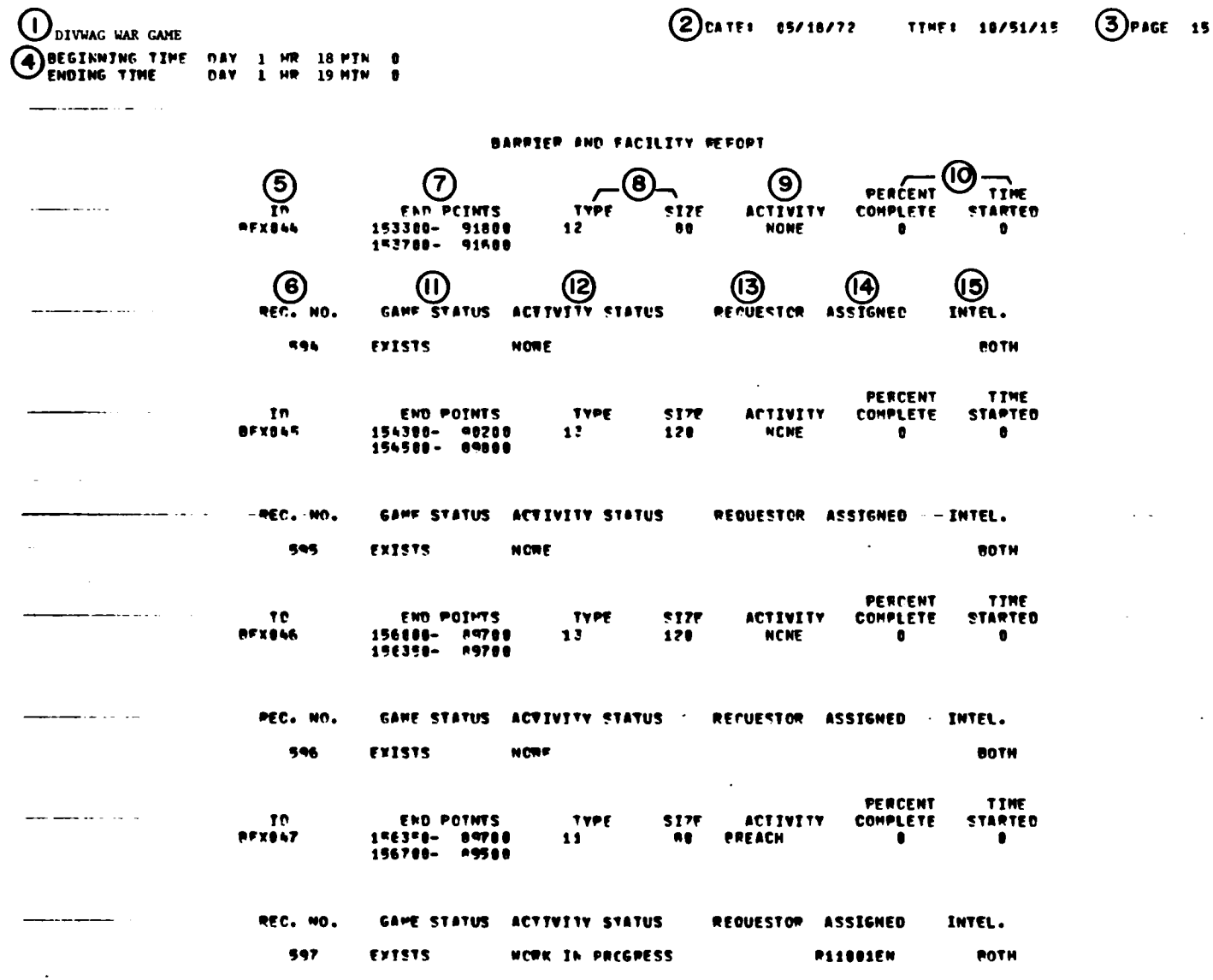


Figure A-15. Example Force Period Planning Report



(1) DIVWAG WAR GAME (2) DATE: 05/18/72 TIME: 18/51/15 (3) PAGE 15

(4) BEGINNING TIME DAY 1 HR 18 MIN 0
ENDING TIME DAY 1 HR 19 MIN 0

BARRIER AND FACILITY REPORT

(5) ID	(7) END POINTS	(8) TYPE	(8) SIZE	(9) ACTIVITY	(10) PERCENT COMPLETE	(10) TIME STARTED
BFX044	153300- 91800 153700- 91400	12	80	NONE	0	0

(6) REC. NO.	(11) GAME STATUS	(12) ACTIVITY STATUS	(13) REQUESTOR	(14) ASSIGNED	(15) INTEL.
594	EXISTS	NONE			BOTH

ID	END POINTS	TYPE	SIZE	ACTIVITY	PERCENT COMPLETE	TIME STARTED
BFX045	154300- 90200 154500- 89800	13	120	NONE	0	0

REC. NO.	GAME STATUS	ACTIVITY STATUS	REQUESTOR	ASSIGNED	INTEL.
595	EXISTS	NONE			BOTH

ID	END POINTS	TYPE	SIZE	ACTIVITY	PERCENT COMPLETE	TIME STARTED
BFX046	156000- 89700 156350- 89700	13	120	NONE	0	0

REC. NO.	GAME STATUS	ACTIVITY STATUS	REQUESTOR	ASSIGNED	INTEL.
596	EXISTS	NONE			BOTH

ID	END POINTS	TYPE	SIZE	ACTIVITY	PERCENT COMPLETE	TIME STARTED
BFX047	156350- 89700 156700- 89500	11	80	BREACH	0	0

REC. NO.	GAME STATUS	ACTIVITY STATUS	REQUESTOR	ASSIGNED	INTEL.
597	EXISTS	WORK IN PROGRESS		P11001EN	BOTH

Figure A-16. Example Barrier and Facility Report

(b) Each barrier or facility is defined geographically by coordinate pair end points (7).

(c) The type (8) is a numerical designator of the engineer task related to that specific barrier or facility. Related directly to the type is the task size associated therewith.

(d) Activity (9) defines the engineer event associated with the barrier or facility. The example in Figure A-16 represents a fixed bridge. When "ACTIVITY" "NONE" appears it is obvious that no one has been assigned the task to destroy it. This is verified by its reported status (10) and (11).

(e) Activity status (12) can be any one of three things:

1. Name.

2. Resources allocated.

3. Work in progress.

(f) When some activity is to occur relative to building or destroying a barrier or facility, some command echelon has to direct it (13), and some unit will be tasked to perform the effort (14).

(g) Intelligence status (15) relates to the question on who has knowledge of the existence of the barrier or facility. It is assumed that both forces know of the existence of all natural obstacles and of most man-made, fixed facilities. Dynamic intelligence functions within the model report on and update intelligence knowledge on all others.

(h) In its current configuration, a single report is produced. The Control Team is responsible to ensure that only the appropriate information is received by respective Player Teams.

d. Period Output Report Analysis. The Chief Controller has overall management responsibility to ensure that Period Output Reports are analyzed for operational acceptability. He will task the Model Maintenance and Analysis Teams as required to resolve any errors/data problems that appear to be model-related. In addition, each Player Team Chief is specifically charged to conduct a detailed analysis of his respective Period Reports and to report his findings to the Chief Controller. If any element is considered by the Team Chief to be operationally unacceptable, that fact is reported in writing, giving reasons.

(1) Analysis by Control Team:

(a) The Intelligence Report is reviewed for irregularities in target acquisitions.

(b) The Force Status Report is reviewed for:

1. Determination of status of major units.

2. Irregularities in major events occurring during the period.

3. Irregularities in movements of units.

4. Irregularities in personnel strengths.

5. Irregularities in mission essential equipment.

6. Irregularities in supply consumption and resupply.

7. Irregularities in battle engagement losses.

8. Irregularities in artillery losses.

9. Irregularities in air ground engagement losses.

10. Irregularities in personnel losses (too high, too low).

11. Irregularities in mission essential equipment losses (too high, too low, for a particular weapon system).

(c) The Barrier and Facility Report is reviewed for irregularities in location and status of barriers.

(d) The Force Period Planning Report is used only for cross-referencing to other reports.

(2) Analysis by Player Teams:

(a) The Intelligence Report is analyzed for irregularities in target acquisitions.

(b) The Force Status Report is analyzed for:

1. Determination of status of units.

2. Irregularities in events occurring during the period.

3. Irregularities in movement of units.

4. Irregularities in unit personnel strengths.

5. Irregularities in unit mission essential equipment.

6. Irregularities in units' battle engagement losses.

7. Irregularities in artillery losses.

8. Irregularities in air ground engagement losses.

9. Irregualrities in unit personnel losses (too high, too low).

10. Irregularities in unit mission essential equipment losses (too high, too low, for a particular weapon system).

(c) Player teams use the Force Period Planning Report as a convenient cross-reference to find the page in the Force Status Report of high interest units. They also use it to update unit locations on the game map.

(d) Each Player Team reviews the Barrier and Facility Report for irregularities in location and status of barriers.

(e) At the completion of the Player Team analysis, the Player Team Chief advises the Chief Controller as to the results of the analysis for his forces and the operational acceptability of the results insofar as related to his team.

1. If he indicates that the results are operationally unacceptable, he will indicate the reasons therefor, the corrective action that must be taken to give acceptable results, and the probable implications of proceeding with the present results.

2. If he indicates that the results are operationally acceptable, he will recommend a basis for proceeding and indicate any corrective action that may be desired for improving the process or results.

e. Exploitation of the Review and Analysis of Period Output:

(1) Based on the advice of the Chief, Model Maintenance Team, regarding the technical validity of the results and the Control Team analysis of the Period Reports, the Game Director makes the final decision as to the operational acceptability of the results.

(2) If his decision is negative, he will advise the Chief, Model Maintenance Team, and the Chief Controller to initiate corrective action and will indicate the scope and extent of corrective action to be taken.

(3) If his decision is positive, he will advise the Chief, Model Maintenance Team, and the Chief Controller to update the game and will advise them as to any corrective action desired in connection therewith.

(4) Procedures for correction of errors are as follows.

(a) Introduction:

1. After completion of the error analysis it will be necessary to correct errors, as required, and then to either initiate a rerun or update the game. This subparagraph deals with the correction of errors.

2. Procedures for correction of errors vary according to the type of correction required. Four types of correction are encountered: corrections to the Orders Input, corrections to the DIVWAG Model logic or technical rules, corrections in ADP processing or control cards, and corrections to constant input data.

(b) Technical and Operational Errors. Irregularities may indicate either operational or technical errors.

1. Operational errors may be due to faulty composition of scenarios or data or exceeding some limiting constraint of the DIVWAG Model. These types of errors may be corrected by preparing new code sheets or revised cards.

2. Technical errors may be due to faulty model logic or technical rules. Correction of this type of problem is the responsibility of the Chief of the Model Maintenance Team.

3. If the results were unacceptable, either technically or operationally, and the results of this game period are critical to the results evaluation analysis, initiate a rerun of the Period Processor. If the results of this game period are not critical to the results evaluation analysis, initiate update of the game as indicated in Paragraph 4 below.

4. Responsibility for correction of errors rests with the element responsible for the error analysis. Responsibility for the decision to rerun the Period Processor or update the game rests with the Game Director. The Chief, Model Maintenance Team, is responsible for:

- In consultation with the Control Team, determining the nature of all model logic or technical rule corrections to be made that will affect evaluation results.
- Effecting the model logic or technical rule corrections agreed upon.
- Advising the Chief Controller and the Game Director in advance on the probable degree of effects on evaluation data of any corrections to be undertaken.

The Chief Controller is responsible for:

- Providing Control Team assistance to the Chief, Model Maintenance Team, in determining the nature of all model logic or technical rule corrections to be made that will affect evaluation results.

- Making recommendations to the Game Director regarding the rerunning of a game period.

(c) Corrections to ADP Processing. These corrections may involve either the work request form or the actual processing in the computer system.

1. Work Request Form Errors. Correction of human errors encountered in preparation of the work request form is effected by preparation of a new work request form with correct information.

a. Responsibility. The Control Team Programmer is responsible for making this type of correction.

b. Post-correction Procedure. Resubmit work request form with related input material.

2. Processing Errors in DPFO. These errors may involve hardware malfunctions or human operator errors. In either case the output or portions of the output may be unusable, and a rerun or partial rerun may be required.

a. Responsibility:

- The DPFO is responsible for correcting the causes of its in-house errors.
- The Control Team Programmer is responsible for coordination of the problem with DPFO, Chief Controller, and Chief, Model Maintenance Team, for determination of the extent of usable portions of the output, and the extent of rerun or partial rerun required.
- The Chief Controller is responsible for making the decision as to the extent of usable and unusable portions of the output, the extent of rerun or partial rerun required, and for initiation of rerun or partial rerun.

b. Post-correction Procedure. The ADP Control Team Programmer resubmits the work request form with related input material as required by the situation.

4. UPDATING OF GAME. There are two separate facets to updating the game: updating displays and updating game operational records.

a. Updating Displays:

(1) Purpose. The updating of displays serves two primary purposes: it provides the basis for a visual presentation of the end-of-period status report (in the final game period this becomes the end-of-game status report);

and, for all game periods except the final one, it provides the basis for planning the military action for the subsequent game period.

(2) Responsibility. The Chief Controller and Chief of each Player Team is responsible for updating and arranging for the necessary photography of situation maps and projection screens in use in his game room.

(3) Procedures. Updating of displays from the period reports and arrangements for photography will be conducted as follows:

(a) Using transparent map symbols, groups post maps and screens, get approval of the final display, remove screens to photography room, attach legend as shown in Figure A-17, and inform the graphics technician on the number of transparencies required.

(b) The graphics technician prepares the transparencies, prepares a camera-ready hard copy of each screen's display, and informs the proper group the work is completed.

(c) The screen is retrieved by the originator who passes the camera-ready hard copy to the Control Team for game records files, and who distributes transparencies as dictated by the Chief Controller.

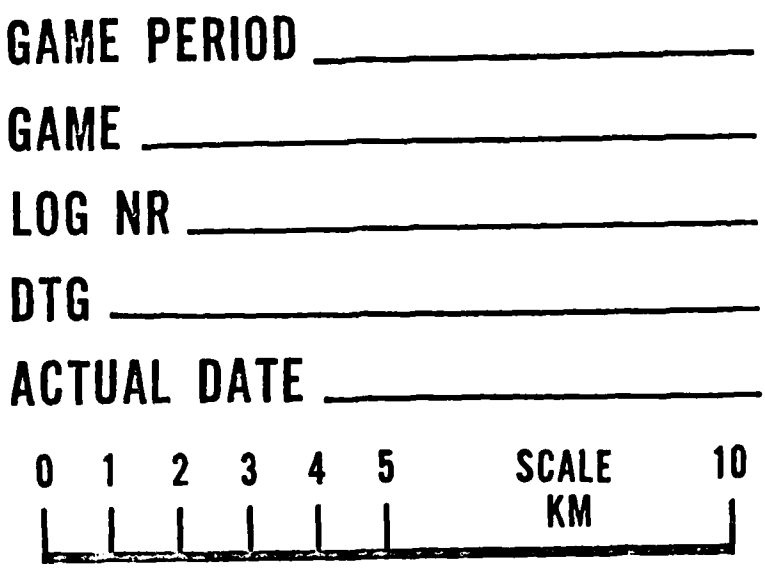


Figure A-17. Display Screen Legend

b. Updating Game Operational Records. Game operational records consist of the data listed below:

- Game Period Concept.
- Orders Input COMPILE.
- Period Reports.
- Graphic Displays.
- Period Narratives.

(1) The Game Period Concept for each period becomes a game document which is included in the Final Report. This document, for each period, should be put in final form during the time the Player Teams are preparing their unit scenarios for that period.

(2) The final DSL COMPILE listing of the game orders input for each period becomes a game document. These listings are not included in the Final Report. They are retained at the War Game Facility for review by authorized, interested parties.

(3) Period Output Reports for each game period become game documents. They are not included in the Final Report. They are retained at the War Game Facility for review by authorized, interested parties.

(4) Graphic displays for each game period become game documents which are included inthe Final Report. They should be prepared as early as possible after the Game Director has approved the acceptability of the period results.

(5) Period Narratives for each game period become game documents which are included in the Final Report. As a general rule the period narrative preparation is delayed, when compared with the other documentation. The reason is straightforward. The first priority, once a game period is determined acceptable, usually is to set up another game period. The theory is that the gaming group can prepare a game period narrative for a given game period while the following period is being processed by the computer.

APPENDIX B

DIVWAG SCENARIO LANGUAGE REFERENCE MANUAL

1. INTRODUCTION. The essential components of the DIVWAG Scenario Language (DSL), as of any language, are a vocabulary; or set of symbols, words, or phrases with specified meanings; and a syntax, or set of rules for combining vocabulary elements. With DSL the vocabulary is limited to a small set of elements, and the syntax is relatively rigid; that is, few syntactic options exist. Within the DSL syntax, the highest level of composition is the Unit Scenario and the Battle Paragraph. This level parallels the paragraph of the English language, generally defined as being composed of one or more sentences and dealing with one point. A Unit Scenario contains the DSL commands for one unit within the DIVWAG system, and a Battle Paragraph contains the definition and instructions for one battle within the Ground Combat Model of the Period Processor. As the paragraph of the English language generally contains an introductory sentence followed by a number of elaborating sentences, so must a Unit Scenario or a Battle Paragraph contain an introductory section and an elaborating body. As a sentence of the English language generally expresses one thought and concludes with appropriate end punctuation, so must each piece of a Unit Scenario or a Battle Paragraph. As punctuation is critical to a proper understanding of written English, it is also critical to proper use of DSL. DSL differs from a language used for human communication in one highly significant aspect, semantic flexibility. In the English language a sentence could be interpreted as having several meanings, and a single thought could be expressed in a multitude of ways. In DSL, an order has only one meaning, and there is only one way to express an order.

2. DSL COMPOSITION:

a. General. The highest level of composition within the DSL syntax is the Unit Scenario or the Battle Paragraph. Each contains an introductory section and an elaborating body. Each statement of the introductory sections or of the elaborating body is similar to a sentence of the English language and must end with a period. Any other use of a period within DSL is illegal; thus, decimal points are not permitted and, although abbreviations are possible within the vocabulary, they are not denoted by the period. The building blocks for a statement are order clauses, conditional clauses, and labels. In the following paragraphs, an order clause is represented by the symbol O, a conditional clause by the symbol C, and a label by the symbol L. Where examples are given below, the prototype order clause STAY UNTIL 011200 will be used, the prototype conditional clause TIME LESS THAN 011830 will be used, and the prototype label ABC will be used. Statements may not exceed 400 characters in length.

b. Unit Scenarios. A Unit Scenario contains the set of DSL orders to be followed by one unit through the course of the game period for which the

DSL is prepared. A Unit Scenario contains one introductory statement and at least one elaborating statement.

(1) Unit Identification. The unit identification is the first statement of each Unit Scenario. It contains the characters ID: followed by the eight-character unit identification (UID) of the unit to follow the orders contained in the scenario. For example:

```
ID:B1234ABC.
```

The colon and period must be present as in the example. The UID must be composed of exactly eight alphanumeric (letters of the alphabet or Arabic numerals) characters, the first of which must be B or R.

(2) Commands. Commands comprise the elaborating body of a Unit Scenario. Each unit identification statement must be followed by at least one command. There is no practical limit on the number of commands which may appear within one Unit Scenario. A command is composed of an optional label, one or more optional conditional clauses, and exactly one mandatory order clause.

(a) Command Syntax. A command may be written in one of the four following basic forms:

```
  O.
L:O.
  IF C, THEN O.
L:IF C, THEN O.
```

Using the prototypes introduced above, these forms are in actual DSL examples:

```
    STAY UNTIL 011200.
ABC:STAY UNTIL 011200.
    IF TIME LESS THAN 011830, THEN STAY UNTIL 011200.
ABC:IF TIME LESS THAN 011830, THEN STAY UNTIL 011200.
```

The following rules of syntax must be observed:

1. If a label is present, it must be the first element of the command.

2. If a label is present, it must be followed by a colon.

3. If a conditional clause is present, it must be stated before the mandatory order clause and after the label (if used).

4. If a conditional clause is present, it must be introduced by the keyword IF and it must be followed by a comma and the keyword THEN, in that order.

5. The order clause must be the final clause of a command.

6. The order clause must be followed by a period.

(b) Syntax for Conditional Expansion. The basic command forms containing conditionals may be expanded to contain more than one conditional in the following forms:

```
  IF C AND IF C AND IF C, THEN O.
L:IF C AND IF C AND IF C, THEN O.
  IF C OR IF C OR IF C, THEN O.
L:IF C OR IF C OR IF C, THEN O.
```

In using the conditional expansion feature, the following additional rules of syntax must be followed:

1. The logical keywords AND and OR may not both appear in one command.

2. The first conditional clause is introduced by the keyword IF; all following conditional clauses are introduced by the keywords AND IF or OR IF.

3. The last conditional clause is followed by a comma and the keyword THEN.

(c) Command Components:

1. The order clause within a command must be composed of one of the orders within the DSL vocabulary with any appropriate modifiers.

2. The conditional clauses within a command must be composed of conditionals contained within the DSL vocabulary with appropriate modifiers.

3. The label within a command must be composed of not more than three alphanumeric characters. Each label within one Unit Scenario must be unique. Labels are used to identify specific commands within a Unit Scenario. The use of labels is treated at length in paragraph 6. The keyword ID may not be used as a label since it is associated with unit identification.

(3) Unit Scenario Execution. A Unit Scenario contains all commands to be followed by the unit identified in the unit identification statement during the game period for which the scenario was written. A unit will follow commands only if it is a resolution unit and if it has a personnel strength of at least one man. (It is assumed that the reader is familiar with the concept of resolution units within the DIVWAG system.) Since a nonresolution unit is not actually active within the Period Processor, any Unit Scenario for a nonresolution unit will be ignored. The Unit Scenario for any resolution unit having less than one man is also ignored.

(a) Sequencing. The first command in a Unit Scenario is always acted upon first. When execution of one command is completed, execution of the succeeding command is initiated. This direct sequencing of commands can be overridden by the proper use of labels and the GO TO order, or the Battle Paragraph, as discussed in paragraph 6.

(b) Execution of One Command:

1. Conditionals. Upon receipt of a command which contains a conditional clause or clauses, the condition is checked prior to execution of the order clause. If the condition stated in the conditional clause does exist, the order clause is executed. If the condition stated in the conditional clause does not exist, the order clause is ignored and the next command is executed. Processing of a command wherein the expanded conditional feature is used is identical except that all conditional clauses are checked. If the logical AND keyword is used, the condition stated in each conditional clause must exist for execution of the order clause. If the logical OR keyword is used, the order clause is executed if the condition stated in any one (or more) of the conditional clauses exists. In either case, the next command is executed if the appropriate conditional criteria are not met.

2. Order Clause. In the absence of conditional clauses or the presence of appropriate conditional criteria, the order clause of a command is executed. Duration of the event initiated by an order clause depends on the nature of the clause. Generally, the Unit Scenario is not reentered until execution of the event initiated by the order clause has been completed. Exceptions are discussed in paragraph 6.

(4) Unit Scenario Preparation. Unit Scenarios are written on standard program coding sheets in free form; that is, the first character can be written in any column of the form, and spacing between characters or a group of characters can be used to improve readability. As many lines as needed may be used for one command, each line representing a punched card. Each command must begin with a new line (new card). The information on the form is then key punched on standard cards, and the cards are assembled in proper sequence to become unit scenarios within the source deck.

c. Battle Paragraphs. One Battle Paragraph serves to identify each battle grouping (battle) within the Ground Combat Model of the Period Processor, to identify the units involved in that battle, to establish the conditions for termination of the battle, and to identify the command within their respective Unit Scenarios that each involved unit is to follow upon termination or the battle. A Battle Paragraph contains two introductory statements and at least one elaborating statement.

(1) Battle Identification (BID). The battle identification is the first statement of each Battle Paragraph. It contains the characters BATTLE: followed by the name associated with the battle (BID). For example:

BATTLE:BULGE.

The colon and period must be present as in the example. The battle identification (BID) must be composed of not more than eight alphanumeric characters; and, within one game period, each BID must be unique.

(2) Battle Declaration. The battle declaration is the second statement of each Battle Paragraph. It contains the phrase SURFACE UNITS:, followed by a list of the UIDs of units which are to be actively engaged in the battle or are to respond to battle conditionals contained in the Battle Paragraph. For example:

SURFACE UNITS:B123ABCD,B111222B,RAB12345.

The colon must be present, the UIDs must be separated by commas, and the period must be present, as in the example. No more than 34 UIDs may be used, and no more than 17 UIDs on either side (Blue or Red) are permitted.

(3) Battle Conditionals. Battle conditionals comprise the elaborating body of a Battle Paragraph. Each battle declaration statement must be followed by at least one battle conditional. There is no practical limit on the number of battle conditionals in one Battle Paragraph. A battle conditional is composed of one conditional clause and a series of labels, where the number of labels must equal the number of units listed in the battle declaration statement.

(a) Battle Conditional Syntax. A battle conditional must be written in one of the following forms:

WHEN C, THEN L,L,L.

WHEN C, AND WHEN C, AND WHEN C, THEN L,L,L.

WHEN C, OR WHEN C, OR WHEN C, THEN L,L,L.

or, using the prototypes listed above form one becomes:

WHEN TIME LESS THAN 011830, THEN ABC,ABC,ABC.

The following rules of syntax must be observed:

1. The logical keywords AND or OR may not both appear in one command.

2. The first conditional clause is introduced by the keyword WHEN; all following conditional clauses are introduced by the keywords AND WHEN or OR WHEN.

3. The last conditional clause is followed by a comma and the keyword THEN.

4. The number of labels must agree with the number of units listed in the battle declaration statement.

5. Labels must be separated by commas.

6. The final label must be followed by a period.

7. Each unit in the battle declaration statement must have a Unit Scenario.

8. The nth listed unit in the battle declaration must have in its Unit Scenario a command which has the nth label listed in the battle conditional.

(b) Battle Conditional Execution:

1. Timing. The list of battle conditional statements within a Battle Paragraph is reviewed after each simulation increment of the named battle within the Period Processor.

2. Sequence. Battle conditionals within a Battle Paragraph are executed in the sequence in which they appear in the paragraph.

3. Condition Met. If, in the course of executing battle conditionals, the condition stated in a given conditional clause does exist, the battle is terminated (another battle increment is not scheduled in the Period Processor); and each unit listed in the battle declaration statement is immediately scheduled to execute the command within its own Unit Scenario which has a label matching the label of that battle conditional associated with that unit. Association of units in the battle declaration and labels in the battle conditional is by position; that is, the nth listed unit is associated with the nth listed label.

4. Condition Not Met. If at the time of execution, the condition listed in a battle conditional is not met, processing continues with the next battle conditional. When all conditionals in a Battle Paragrap have been processed, and none of the stated conditions exists, a new battle increment is scheduled in the DIVWAG Period Processor.

3. DSL ORDER CLAUSES:

a. General. The previous paragraph introduced the order clause and the the conditional clause as components of a DSL statement. This paragraph presents the elements of a DSL order clause, and paragraph 4 presents elements of a DSL conditional clause.

(1) Each order clause is composed of exactly one basic order, a variable number of order modifiers, and a variable number of data elements. In the following discussion, elements of DSL will always be written in upper case letters to differentiate from the accompanying narrative.

(2) The DSL Compiler does not recognize English words. It recognizes DSL elements. For example, the compiler recognizes the basic order FIRE as one DSL element. It also recognizes the basic order FIRE ON TARGETS OF OPPORTUNITY as one DSL element. The user must take care to provide the total DSL element when preparing DSL orders.

(3) Order modifiers may be mandatory, exclusive, or optional. A mandatory order modifier is one which must appear each time the basic order with which it is associated appears. A set of exclusive order modifiers is a group of modifiers, exactly one of which must appear each time the associated basic order appears. An optional order modifier is one which may appear with the associated basic order but is not required by the DSL Compiler.

(4) A data element may be associated with a basic order or with an order modifier. Data elements are never optional; that is, where a data element is associated with a basic order or an order modifier, the data element must be present.

(5) The first element of an order clause is always a basic order. If a data element is associated with a basic order, it is always the second element of an order clause. Order modifiers and associated data may be written after the basic order and its data element (if any) in any sequence, with the limitation that a data element associated with any modifier must immediately follow the modifier. Punctuation, or any entry not specifically identified as part of a DSL element, is not allowed.

b. DSL Basic Orders. Basic DSL orders are grouped within six generic categories: stay, move, engage, engineer, transfer, and pseudo orders. These categories contain basic orders for which the simulated activity is generally similar. In most cases, the various orders generate different secondary actions which are discussed with the appropriate basic order.

(1) Stay Activity Orders. Units with a stay activity are motionless. They will consume class I and class III supplies. If on the ground, they may be assessed by area fires and by aerial attack and, if air defense units, may fire upon enemy aircraft. Other capabilities of units with stay activity orders depend upon the specific order.

(a) STAY. The STAY order requires one of the exclusive modifiers FOR (a specified period of time) or UNTIL (a specified time). For example:

```
STAY FOR 1 HOUR.
STAY UNTIL 010230.
```

If the unit is an artillery unit it will enter the TACFIRE Model of its division automatically and will fire upon targets if so directed by TACFIRE. This is also the default order. If a resolution unit has no Unit Scenario, or if all commands in its Unit Scenario are completed, the Period Processor will automatically generate a STAY UNTIL (end of the game period) for the unit.

(b) FIRE ON TARGETS OF OPPORTUNITY. This order should only be given to artillery units. It requires the same modifiers as the STAY order and, for an artillery unit, has the same effect as a STAY order. Examples:

FIRE ON TARGETS OF OPPORTUNITY FOR 30 MIN.
FIRE ON TARGETS OF OPPORTUNITY UNTIL 011230.

(c) PREPARE. The PREPARE order requires one of the exclusive modifiers FOR (a specified period of time) or UNTIL (a specified time) and allows the optional modifiers AT WIDTH (unit front in meters) -DEPTH (unit depth in meters). For example:

PREPARE UNTIL 031500.
PREPARE FOR 12 HOURS AT WIDTH 1500 - DEPTH 500.
PREPARE AT WIDTH 2000 - DEPTH 775 FOR 1 DAY.

The PREPARE order causes the unit to assume a defensive posture at its current location. If unit dimensions are specified, these are used. If unit dimensions are not specified, those loaded in the data base for a defensive posture are used. This is one of the three orders under which a unit may become involved in battle within the Ground Combat Model of the Period Processor. Rules for such engagement are discussed under the ENGAGE order. An artillery unit given the PREPARE order does not enter the TACFIRE Model.

(d) LOITER. The LOITER order requires the three modifiers: FOR (a specified period of time), AT ALTITUDE (a specified altitude in feet), and AT SPEED (a specified flight speed in knots). For example:

LOITER FOR 15 MIN AT ALTITUDE 3000 FT AT SPEED 30 KNOTS.

The LOITER order should be given to aircraft units only. The unit will remain at its current location and specified altitude for the specified period of time. Flight speed is used to determine fuel consumption. Since an aircraft unit under the LOITER order is not vulnerable to air defense, the order should only be used for units over friendly territory.

(2) Move Activity Orders. Move activity orders direct surface and air movement. The general requirement of these orders is specification of the route the unit is to follow. The unit is moved from its current location to each point specified within the order clause along a straight line. Class I and class III or IIIA are generally consumed, and ground units are generally vulnerable to area fire and aerial fire. Vulnerability of air units depends on the order. Other actions depend upon the specific order.

(a) MOVE. The MOVE order is the prototype order for ground movement. The modifier TO (series of X-Y coordinates) is mandatory, and the modifiers BY (travel mode mnemonic) and PRIORITY (movement priority = 1,2,3, or 4) are optional. For example:

```
MOVE TO 0123000-0096500.
MOVE BY TCCM TO 0115000-0095750,
  0115000-0098500, 0117500-0100000
  PRIORITY 3.
MOVE TO 0116000-0172500 BY TCCM.
MOVE PRIORITY 1 TO 0098000-0118800.
```

The MOVE order causes ground movement over the specified route. Movement mode used by the DIVWAG Movement Model is as specified or, if the BY modifier is not present, cross country deployed movement is assumed. The priority code, used by the DIVWAG Engineer Model in allocation of engineer resources should an obstacle be encountered on the move, is set to 4 if the PRIORITY modifier is not present.

(b) WITHDRAW. The WITHDRAW order uses the same modifier structure as the MOVE order and, additionally, the optional AT WIDTH (unit front in meters) and - DEPTH (unit depth in meters) modifiers may be used. For example:

```
WITHDRAW TO 0117000-0098000 AT WIDTH 2000-DEPTH 880.
WITHDRAW AT WIDTH 3000-DEPTH 500 BY TCCD
     TO 0088000-0115000,0098000-0117000,
              0102500-0118000 PRIORITY 1.
```

The WITHDRAW order combines effects of the MOVE and PREPARE orders. It causes a unit to assume a withdrawal posture while accomplishing ground movement. This is one of the three orders under which a unit may become engaged in battle within the DIVWAG Ground Combat Model. Engagement procedures are discussed under the ENGAGE order.

(c) ADVANCE. Modifier requirements of the ADVANCE order are identical to those of the WITHDRAW order with the restriction that only one pair of coordinates may be specified. For example:

```
ADVANCE TO 0101500-0101888.
ADVANCE BY TCCR AT WIDTH 1200-DEPTH
    1000 TO 0123400-0090500.
```

The ADVANCE order is the third order under which a unit may become engaged in ground combat. The unit assumes an attacking posture and proceeds toward the specified objective which, for proper ground combat engagement, should be to the rear of an opposing maneuver unit. Engagement procedures are discussed under the ENGAGE order.

(d) FLY. In using the FLY order, the three modifiers OVER (series of X-Y coordinates) AT SPEED (air speed in knots) AT ALTITUDE (altitude in feet) are mandatory. For example:

```
FLY AT SPEED 125 AT ALTITUDE 2500
   OVER 0111000-0088000.
```

This order is issued to an air unit to cause it to move along a flight path from its present location to a specified coordinate point. A list of coordinates following the modifier OVER is used to describe end points of all legs of the flight path. The air unit will be located (land) at the last point listed. FLY orders should be reserved for administrative movement over nonhostile territory.

(e) AIRMOBILE ASSAULT. In writing this order the modifier TO (series of X-Y coordinates) is mandatory, and the modifier AT TIME (specified time) is optional. For example:

```
AIRMOBILE ASSAULT TO 0111000-0111000,0123000-
     0111000.
AIRMOBILE ASSAULT AT TIME 030500 TO
     009530-0088000.
```

This order causes the airmobile assault segment of the DIVWAG Airmobile Model to be activated. The airmobile task force conducts an airmobile movement along the specified flight path. Initiation of movement is scheduled such that leading elements of the airmobile task force arrive at the final coordinate if this is possible considering flight speeds, distance, and time the order is received. If the AT TIME modifier is not used, movement is initiated when the order is received. The airmobile task force is vulnerable to air defense weapons. To properly execute the order, the airmobile task force must have previously received an ACCEPT TRANSPORT order. Techniques for inclusion of this order in a Unit Scenario are discussed in paragraph 6.

(f) RECONNOITER. In writing the RECONNOITER order, the four modifiers BY (reconnaissance control code), OVER (series of no more than seven X-Y coordinates), AT SPEED (flight speed in knots) and AT ALTITUDE (altitude in feet) are all mandatory. For example:

```
RECONNOITER BY H322 OVER 0123000-0122000,
    0123000-0117000, 0133000-0117000,
    0133000-0122000 AT SPEED 50 AT
     ALTITUDE 100.
```

Processing of the order varies depending upon the nature of the unit receiving the order and the reconnaissance control code.

1. If the first character of the reconnaissance control code is the letter A, the unit receiving the order must be an Air Force reconnaissance control flight. The entire unit conducts the mission flying at the specified altitude and speed over the specified route. The fourth character of the reconnaissance control code specifies the sensor load. Sensors are activated upon receipt of the order and remain active over the entire flight path.

2. If the first character of the reconnaissance control code is the letter M, the unit receiving the order must be an army surveillance

aircraft (Mohawk type) flight. The entire unit conducts the flight as outlined in the previous paragraph. The fourth character of the reconnaissance control code identifies the sensor package (which must include the side looking airborne radar (SLAR) with a ground terminal), and the second and third characters control range, delay, and direction of the SLAR.

3. If the first character of the reconnaissance control code is the letter H or F, the unit receiving the order must be an army unit containing light observation helicopters (H) or light fixed wing scout aircraft (F). In response to the order, a mission unit is created to conduct the mission. The mission unit flies to the first coordinate, at which point target sensing may commence. Upon completion of the mission, the mission unit returns to the unit which received the order. The mission unit may conduct a route or an area reconnaissance, as determined by the control code and discussed in paragraph 6.

4. In all cases, the RECONNOITER order provides the ability to control airborne sensors. Aircraft responding to a RECONNOITER order are vulnerable to air defense weapons.

(3) Engagement Orders. The group of engagement orders permit the game staff to control application of firepower within the Period Processor. The FIRE order controls both the Area Fire and Nuclear Assessment Models; the ENGAGE order controls the Ground Combat Model; the MISSION IS order controls the Air Ground Engagement Model. It is axiomatic that these orders be given only to appropriate units. FIRE orders should be given only to units capable of delivering conventional or nuclear indirect fires. ENGAGE orders should be given only to maneuver units capable of engagement within the Ground Combat Model. MISSION IS orders should be given only to units capable of carrying out a close air support mission either with attack helicopters or tactical Air Force aircraft.

(a) FIRE. The FIRE order activates the Area Fire or Nuclear Assessment Model. It should, of course, appear within the Unit Scenario of a unit that is capable of carrying out the fire mission. The FIRE order structure depends upon whether a conventional or nuclear fire is required.

1. For conventional fires the FIRE order must contain the mandatory modifiers ON (coordinates of target) and MUNITION TYPE (Area Fire munition code beginning with A) and one of the exclusive modifiers, NUMBER OF ROUNDS (a number), NUMBER OF VOLLEYS (a number), or IMPACT RADIUS (a number). For example:

```
FIRE ON 0123000-0098500 NUMBER OF ROUNDS
   25 MUNITION TYPE A013 IMPACT
   RADIUS 100.
```

The unit receiving the order will fire the specified number of rounds or volleys of the type specified upon the specified location.

2. For nuclear fires, four modifiers should be viewed as mandatory. These are ON (desired ground zero), MUNITION TYPE (munition code starting with N or D), NUMBER OF ROUNDS 1, and HEIGHT OF BURST (preset height of burst option index). IMPACT RADIUS (desired height of burst if not preset) is required if HEIGHT OF BURST is not preset. The desired ground zero is specified in terms of one X-Y coordinate pair. The munition code is a four-character alphanumeric code wherein the first character must be N or D and the remaining characters relate to the Nuclear Assessment Model constant data base, allowing specification of a firing weapon, a munition, a fuzing option, and a yield. Specification of a height of burst depends upon whether the specified fuze allows free selection of height of burst or only preset height options. If preset options are used, the modifier HEIGHT OF BURST is followed by a height index (1, 2, 3, 4). If free selection of a height of burst is possible, the HEIGHT OF BURST is followed by the number zero; and IMPACT RADIUS, by desired height in meters. Examples:

```
FIRE ON 0127000-0115000 NUMBER OF ROUNDS 1
   MUNITION TYPE NA33 HEIGHT OF BURST 2
   IMPACT RADIUS 100.

FIRE ON 0127000-0115000 NUMBER OF ROUNDS 1
   MUNITION TYPE NXA2 HEIGHT OF BURST 1
   IMPACT RADIUS 500.
```

(b) ENGAGE. The ENGAGE order has one mandatory modifier, IN BATTLE (battle name), and is always used in conjunction with the ADVANCE order For example:

```
ADVANCE TO 0123100-0125000.
ENGAGE IN BATTLE BRAVO.
```

The combination of an ADVANCE order followed by an ENGAGE order is used to initiate a battle within the DIVWAG Ground Combat Model. Each time an ADVANCE order is encountered within a Unit Scenario, the next command is checked for an ENGAGE order. If the ENGAGE order is not found, the ADVANCE is executed as a simple movement event. If an ENGAGE order is found, the following sequence of events takes place:

1. The list of units involved in the battle named in the ENGAGE order is obtained from the battle declaration statement of the appropriate Battle Paragraph.

2. From the list of all units involved in the battle, those units which are on the opposing side of the unit in whose scenario the ENGAGE order appears and whose current order is either PREPARE or WITHDRAW are selected. These units constitute potential opponents.

3. The list of potential opponents is checked for proximity to the advancing unit. If no potential opponents are within 3000 meters

(front-to-front) of the advancing unit, the battle is not initiated. (The process will be repeated as each Movement Model increment generated by the ADVANCE order is initiated.)

4. If a potential opponent is within 3000 meters of the advancing unit, the battle is initiated by scheduling the first Ground Combat Model increment. The increment is scheduled to take place after the standard Ground Combat Model increment length (15 minutes) has elapsed.

5. At the scheduled time, any unit listed in the Battle Paragraph which has an ADVANCE, PREPARE, or WITHDRAW order (a combat enabling order) will engage all units of the opposing force, also listed in the Battle Paragraph, and also having a combat enabling order and within 3000 meters.

6. The force to which the unit that had the initiating ENGAGE order belongs is treated as the attacking force within the Ground Combat Model.

(c) MISSION IS. The MISSION IS order is used to control the Air Ground Engagement Model. The order clause must contain the three mandatory modifiers TARGET NUMBER (a target intelligence index code from a DIVWAG intelligence report), NUMBER OF AIRCRAFT (a specified number), and AIRCRAFT TYPE (a specified equipment item code) and may contain the optional modifier AT TIME (a specified time). For example:

MISSION IS TARGET NUMBER 480001 AIRCRAFT TYPE 87
NUMBER OF AIRCRAFT 4 AT TIME 030720.

This order must be within the Unit Scenario of a unit that is capable of aerial attack of a target. Upon receipt of the order a mission unit is formed from the unit receiving the order, where composition of the mission unit is as specified in the order; and the Air Ground Engagement Model simulation of the mission unit strike against the specified target is scheduled. If a time is specified, and it is possible to strike the target at the specified time, the Air Ground Engagement Model events are scheduled accordingly. If a time is not specified or is specified but unattainable, scheduling of the first portion of the model takes place at once; and the strike will occur after appropriate delays within the model data base have passed. To function properly, the unit must have the specified number and type of aircraft available (except if an Air Force unit and the aircraft is an appropriate TACAIR item). This may be ensured by use of the RETAIN order, discussed in a subsequent paragraph.

(4) Engineer Activity Orders. The DIVWAG Engineer Model functions as a resource allocation filter, controlling the assignment of engineer resources to tasks that must be accomplished. In consonance with this approach, ESL orders controlling engineer activity are task oriented rather than unit oriented. For a given game period, all commands requesting engineer tasks are consolidated within one Unit Scenario for each force, and the scenarios

given the unit identification BLUEFORC or REDFORCE as appropriate. Three basic DSL orders are used to initiate engineer activity, and one DSL order stops activity on a given task.

1. Activity Initiation Syntax. The basic DSL orders to initiate engineer activity are BUILD, BREACH, and REMOVE. Order clauses are built around these basic orders identically. The order clause contains the basic order; one of the exclusive modifiers BARRIER or BRIDGE or FACILITY, followed by a barrier facility identification; one of the exclusive modifiers BEGIN BY or COMPLETE BY, followed by a specified time; optionally, the modifier PRIORITY followed by a priority indicator 1, 2, 3 or 4; optionally, one of the modifiers MANDATORY or DESIRED. Several examples follow:

```
BUILD BARRIER MNA007 BEGIN BY 010800.
REMOVE BARRIER MNA028 MANDATORY
     COMPLETE BY 020705.
BREACH MANDATORY PRIORITY 1 COMPLETE BY
       010715 BARRIER MNT001.
BUILD BRIDGE BRF011 BEGIN BY 022200
      DESIRED.
REMOVE FACILITY BFL003 BEGIN BY 041730
      PRIORITY 3.
```

2. Activity Initiation Response. The BUILD function is defined as construction of a new barrier or facility or repair and rebuilding of one that has been breached. The BREACH function is the disruption of the functional purpose of the obstacle or facility, while the REMOVE function is total destruction or dismantling and removal for use elsewhere. The modifiers BRIDGE and FACILITY are interchangeable. The Engineer Model operates upon a group of tasks, assigning resources to complete or initiate tasks as closely to the times requested as is possible. The user should be familiar with the priority algorithms used by the Engineer Model when assigning the optional modifiers. Briefly, all task orders having the modifier MANDATORY will have preference before task orders having the modifier DESIRED. If neither of the modifiers is used, the task order is treated as if the DESIRED modifier were present. The PRIORITY modifier and its data are used as a tie-breaker between task orders otherwise identical. If the modifier is not used, the task order is treated as though the modifier PRIORITY 4 had been present.

3. Relation to Automatic Task Requests. The DIVWAG Movement Model will generate automatic requests when a moving unit encounters an obstacle. The order will be to BREACH if the obstacle is breachable or to BUILD a facility if the obstacle is a natural obstacle. An automatic order will always be treated as having the modifier MANDATORY, the modifier BEGIN BY (time the obstacle is encountered), and PRIORITY (the priority associated with the movement event).

4. Task Cessation. Any engineer activity may be halted by the DSL order STOP TASK (barrier/facility identification). For example:

```
STOP TASK MNA013.
```

Work on the specified task halts at once, and any resources committed to the task are available for reassignment.

(5) Transfer Orders. The set of transfer activity orders provide a means for various administrative and organizational controls to be implemented within the model.

(a) JOIN. The JOIN order has one mandatory modifier UNIT (a UID) For example:

JOIN UNIT R1122333.

Receipt of this order causes the unit so ordered to integrate into another organization. The unit is completely absorbed by the receiving unit, its strength being reflected by the receiving unit in any subsequent actions. Once a unit joins another unit, it can accept no more orders until it has been detached. This order is used to change task organizations and, concurrently, results in the detail of resolution being reduced as several units join into one superior. If the receiving unit (unit being joined) had been a nonresolution unit prior to execution of the order it assumes the location of the joining unit and, if a Unit Scenario is provided, will immediately execute the first command of its Unit Scenario.

(b) DETACH. The DETACH order requires the mandatory modifier UNIT (a UID) and may have the optional modifier TYPE (a UTD). For example:

DETACH UNIT R1122BAR.
DETACH UNIT B113MECH TYPE GRMI.

The DETACH order causes the named subunit to be broken out of the superior unit receiving the order (e.g., one company out of a battalion). Without the optional modifier, TYPE, the detached unit is formed with its pro rata share of the superior unit's strength (personnel and equipment). When the optional modifier, TYPE, is used, the detached unit will be broken out at its full authorized strength, to the extent that the strength of the superior unit allows. The detached unit is initially given the same location as the unit from which it was detached and will immediately begin to follow any DSL orders provided for it within a Unit Scenario. The detaching, or superior, unit will maintain all residual strength, if any, and will continue to follow DSL orders as long as it has residual strength. Combined use of the DETACH and JOIN orders provides the ability to restructure organizations in any manner desired, limited only by the quantity and definition of units within the game. Used in isolation, the DETACH order results in an increase in the detail of unit resolution. Proper functioning of the order requires that the unit being detached is already defined to the game, insofar that it must have been defined as a subordinate of the unit from which detached either within the task organization at the start of the game or through a previous JOIN order. The DETACH order with optional TYPE modifier may also be used to introduce new units to the game if, within the original task organization,

the unit receiving the DETACH order was defined as being of a nonbasic UTD and having no subordinates. In this case the UTD of the superior unit must be defined within TOE data as containing the UTD of the unit specified in the DETACH order.

(c) ASSUME CONTROL OF. This order, followed by the modifier, UNIT, causes the named unit to come under control of the unit receiving the order. Upon implementation of the order, status reports for the assuming unit will reflect strengths of the new subordinate. If the named unit is not already under control of the assuming unit and is not a resolution unit, it will be detached from its superior upon execution of the order. Example:

ASSUME CONTROL OF UNIT B1212123.

(d) ASSIGNMENT IS. This order, followed by an exclusive modifier, DIRECT SUPPORT OF UNIT, REINFORCING UNIT, GENERAL SUPPORT, or GENERAL SUPPORT-REINFORCING UNIT, causes the unit receiving the order to have the designated assignment for allocation of its supporting resources. Applications are within the TACFIRE Model, where fire support is allocated per assignment; within the Air Ground Engagement Model, where aerial fire support may be allocated by assignment; within the Airmobile Model, where allocation of lift and escort aircraft is per assignment; and in the Engineer Model, where allocation of engineer resources may be per assignment. Only the DIRECT SUPPORT assignment is actually acted upon within the Period Processor, the other assignments simply provide the user means of documenting organizational features of the force. In all cases, the GENERAL SUPPORT assignment serves to cancel previous assignments. Examples:

ASSIGNMENT IS GENERAL SUPPORT.
ASSIGNMENT IS DIRECT SUPPORT OF UNIT B1111111.
ASSIGNMENT IS REINFORCING UNIT B1234567.
ASSIGNMENT IS GENERAL SUPPORT-REINFORCING
UNIT B1212123.

(e) ACCEPT TRANSPORT. This order initiates the first segment of the Airmobile Model, which allocates aircraft and moves the aircraft to the location of the airmobile task force to be lifted. The ACCEPT TRANSPORT order must appear in the Unit Scenario of the unit being lifted and must precede the AIRMOBILE ASSAULT order for which aircraft are being allocated. The MIX modifier identifies the type lift and escort aircraft to be used and a standard lift to escort ratio. (This ratio is overridden by use of the NUMBER OF ESCORTS modifier.) The Airmobile Model allocates the specified number of lift aircraft, if the NUMBER OF AIRCRAFT modifier is used, or sufficient aircraft to move the entire unit in the specified number of trips, if the NUMBER OF TRIPS modifier is used. If the AT TIME modifier is used, aircraft are scheduled to arrive at the location of the unit to be lifted at the specified time. If such a time is not specified aircraft arrive as soon as possible after receipt of the order.

(f) RELEASE TRANSPORT. This order requires no modifiers or data. For example:

RELEASE TRANSPORT.

The RELEASE TRANSPORT order may appear in the Unit Scenario of an airmobile task force. If it appears it must not precede the AIRMOBILE ASSAULT order. In response to the RELEASE TRANSPORT order, all aircraft are returned to their home bases upon completion of the airmobile movement or upon receipt of the order, whichever occurs later. If the order is not used, aircraft remain with the airmobile task force.

(g) RETAIN. The RETAIN order has two mandatory modifiers: NUMBER OF AIRCRAFT (a specified number) and AIRCRAFT TYPE (an equipment item code). For example:

RETAIN AIRCRAFT TYPE 188 NUMBER OF AIRCRAFT 8.

This order should be reserved for use in the Unit Scenario of a unit which is capable of flying attack helicopter strikes within the Air Ground Engagement Model. When the order is used, the specified type and number of aircraft are exempt from automatic scheduling by the Air Ground Engagement Model. The order is intended to be used in conjunction with the MISSION IS order, to ensure availability of sufficient aircraft to conduct strikes ordered by the game staff. Aircraft are released for automatic scheduling as they return from a DSL ordered strike. Aircraft may also be released for automatic scheduling by a new RETAIN order, where the specified number is less than the number of aircraft currently retained. For example:

RETAIN AIRCRAFT TYPE 188 NUMBER OF AIRCRAFT 0.

(6) Pseudo Orders. Two DSL pseudo orders can be used in the construction of Unit Scenarios. The orders are so called because they differ from those described above with respect to their reasons for existence. They are not used to direct units to perform military activities but rather are inserted into Unit Scenarios to perform the functions described below.

(a) GO TO. The GO TO order is used to direct a unit to follow a set of orders in a particular sequence or with particular exceptions, depending on the order string structure and satisfaction of conditional statements. A GO TO order must be followed by a statement label. For example, the statement GO TO 6 may be inserted in an order string to direct the unit to start executing a statement labeled 6 immediately. Statement 6 may follow several others in the order string. If so, the orders between the statement GO TO 6 and statement 6 will be ignored by the unit.

(b) TERMINATE. This order, when encountered in any unit's scenario, will cause all simulation to halt and terminate the period. It is most useful in those cases where important or critical situations are expected to occur and for which contingency planning is not feasible or particularly desirable. The TERMINATE order should be used sparingly and with caution

because it will halt all processing. To continue the war game a new game period, with complete DSL instructions for all units, must be prepared.

(7) Scatterable Mine Order. The emplacement of scatterable mines by indirect fire or aerial delivery means is directed by the EMPLACE order. This order is limited to field emplacement by indirect fire or aerial means. The emplacement of scatterable minefields by more conventional ground means is treated through the Engineer BUILD order described in paragraph 3b(4) above.

(a) System. The EMPLACE order must be followed by the mandatory modifiers FIELD (followed by a 6-character minefield identifier) and MUNITION TYPE (followed by a 4-character munition code). Additionally, one of the exclusive modifiers NUMBER OF ROUNDS, NUMBER OF VOLLEYS, or NUMBER OF TRIPS (followed by an integer number) must be used.

(b) Emplacement by Indirect Fire. Emplacement of minefields by indirect fire can be accomplished by, and the order may be given to, only artillery firing units. Such units are identified within the model as units which have the letters FA in the third and fourth characters of the Unit Type Designators. For example, units with the following UTD would accept the EMPLACE order for indirect fire minefield delivery: GFFA, MBFA, NSFA, etc.

1. The field to be emplaced is identified by the modifier FIELD (field identification where the field identification is a six-character mnemonic. The first three characters must be MVA, MNP, MNT, or MNS and the last three characters must be integers in a range depending on the first three:

MNA001 - MNA500

MNP001 - MNP150

MNT001 - MNT150

MNS001 - MNS500

2. The munition mnemonic must be of the form AOnn where nn ranges from 01 to 36; this should be the code of a weapons/munition mix loaded for minefield delivery within the Area Fire Model data load.

3. In response to the EMPLACE order, the ordered unit will fire the designated number of rounds or volleys of the designated type into the area of the specified minefield. Delivery is dependent on the field being within the range capabilities of the specific/munition combination. Should the firing unit have fewer than the desired number of rounds, all munition available to the unit will be fired.

(c) Emplacement by Aerial Means. Aerial emplacement can only be accomplished by an aerial-type unit; that is, by a unit having a UTD which ends with the character H or Y. The same restrictions on the minefield name as were presented for indirect fire delivery apply.

1. For aerial emplacement, the MUNITION TYPE modifier must be followed by a 4-character aerial emplacement code.

a. First character of the aerial emplacement code must be A, C, or H, designating emplacement by high performance (A), fixed wing cargo type (C), or helicopter (H). If helicopter delivery, the UTD of the unit receiving the order must end with H; otherwise, the UTD of the ordered unit must end with Y.

b. Second character of the aerial emplacement code must be an integer 0, 1, or 2. This specifies mission abort criterion: 0=do not abort in any case; 1=abort if aircraft fired upon; 2-abort if aircraft losses are experienced.

c. Third character of the aerial emplacement code is an integer in the range 1-9. This specifies an index for mean height at the dispensing site, where the height values are loaded in constant data base.

d. Fourth character of the emplacement code is an integer 1-9. This specifies an aircraft mix table (type and number of mines and type of aircraft) to be used in emplacement. The mix tables are part of the model's constant data load.

2. In response to the order, the number of aircraft specified in NUMBER OF TRIPS of the type in the appropriate mix table will be given full loads, as specified in the mix table, and will be sent to emplace the named field as a single mission unit.

c. DSL Order Modifiers and Data Elements. Most of the DSL order modifiers and some basic DSL orders require data elements to complete an order clause. The required format of a data element depends on the order or order modifier with which it is associated. This paragraph discusses the order modifiers and all required data elements.

(1) There are two basic rules regulating the entry of data elements when required by an order or an order modifier:

(a) A data element must follow the order or order modifier with which it is associated. In the following examples data elements are underlined:

FLY AT SPEED 150 KNOTS AT ALTITUDE 3000 FEET
OVER 0112000-0098500 0115000-0127500.

ADVANCE TO 0113000-0127000 BY TCCD
AT WIDTH 2000M-DEPTH 1500M PRIORITY 1.

(b) Units of measure may be used as parts of data elements to provide clarification; however, the system requires that each type of data be input in a specific unit of measure. For example, aircraft speed must be in knots, and aircraft altitude must be in feet. Only units of time measure are actually recognized as key words by the compiler. Periods must not be used to terminate abbreviations; they are used exclusively to terminate statements. If units of measure are used in DSL statements, they must be restricted to the following forms:

- DAY, DAYS, DA, or DAS
- HOUR, HOURS HR, or HRS
- MINUTE, MINUTES, MIN, or MINS
- FEET or FT
- METER, METERS, or M
- KNOT or KNOTS.

(2) Format of data elements generally must follow a rigid pattern. An exception is the specification of a time or a period of time. Times may be expressed either by a six-digit date time group or in clear text. In either case interpretation of the data element as a specific time or as a period of time depends on the modifier with which it is used.

(a) The first form uses an integer number of six digits with the digits in three blocks of two digits each. The blocks are in fixed order. The leftmost block represents the number of days, the center block the number of hours, and the rightmost block the number of minutes. If fewer than six digits are used, a zero fill on the left is assumed. Examples:

112233 (denoting 11 days, 22 hours, and 33 minutes)

1122 (read as 001122 with zero fill on the left, denoting 11 hours and 22 minutes)

0800 (read as 000800, denoting 8 hours)

126 (read as 000126, denoting 1 hour and 26 minutes).

(b) The second form uses integer numbers of days, hours, and minutes, each of which must be followed by the word DAY, HOUR, or MINUTE (or abbreviations thereof as listed above). The words DAY, HOUR, and MINUTE (or abbreviations) are recognized by the compiler; therefore, the data may be written in any order and with any omissions. Examples:

1 DAY 12 HOURS 10 MINUTES

12 HOURS 10 MINUTES 1 DAY

12 HR 10 MIN

120 MIN

2 HRS

(3) For those orders and order modifiers that require data elements, specific data formats have been established. All order modifiers and those basic orders requiring data elements are presented below in alphabetical order.

(a) AIRCRAFT TYPE (equipment item code). The data element is an integer between 1 and 200 denoting the equipment item code of aircraft. Example:

AIRCRAFT TYPE 188

(b) AT ALTITUDE (height of aircraft in feet). The data element is an integer. Example:

AT ALTITUDE 6000 FT

(c) AT SPEED (velocity of aircraft in knots). The data element is an integer. Example:

AT SPEED 375

(d) AT TIME (a specified time). The data element is a time group as described above. Examples:

AT TIME 011230
AT TIME 1 DAY 12 HR 30 MIN

(e) AT WIDTH (unit frontage in meters). The data element is an integer value used in conjunction with-DEPTH. Example:

AT WIDTH 2000M -DEPTH 1200M

(f) BARRIER (barrier identification code). The data element is a six-character mnemonic, the first three characters being alphabetic and the last three characters numeric. Example:

BARRIER MNA013

(g) BEGIN BY (a specified time). The data element is a time group as described above. Examples:

BEGIN BY 010800
BEGIN BY 8 HOURS 1 DAY

(h) BRIDGE (facility identification code). The data element is a six-character mnemonic, the first three characters being alphabetic and the last three numeric. Example:

BRIDGE BFX103

(i) BY (code). Two cases exist:

1. BY (movement mode mnemonic). The data element consists of four alphabetic characters, comprising a movement mode mnemonic for the Movement Model. See Figure B-1. Example:

BY TCCD

2. BY (reconnaissance control code). The data element consists of four alphanumeric characters, the first of which is A, M, F or H, comprising a control code for the Reconnaissance Overlay. Example:

BY AXX3
BY MAL6
BY HR36
BY H425

Travel Mode	Definition	Description
Movement type		
A	Administrative	Movement of units by road nets. Uses the most efficient transportation systems available.
B	Tactical	Movement as part of an attack, withdrawal, or other tactical plan external to movement within Ground Combat engagements.
Route type		
CC	Cross country	Route is subject to natural terrain conditions.
RA	Paved roads	Route is such that road beds are asphalt or concrete with at least two lanes with good shoulders.
RG	Gravel roads	Route is gravel or similar surfaced road.
RD	Dirt roads	Route is dirt, road is narrow and/or marginally maintained.
Formation		
M	Column march	Unit is in a column formation.
R	Reconnaissance.	Unit on a ground reconnaissance type mission.
D	Deployed.	Unit is partially deployed in anticipation of imminent contact with the enemy.

Recognized movement combinations

ARAD	ARDD	ARGD	TRAD	TRDD	TRGD	TCCD
ARAM	ARDM	ARGM	TRAM	TRDM	TRGM	TCCM
ARAR	ARDR	ARGR	TRAR	TRDR	TRGR	TCCR

Figure B-1. Travel Mode Mnemonic Descriptions

(j) COMPLETE BY (a specified time). The data element is a time group as described above. Examples:

COMPLETE BY 031720
COMPLETE BY 3 DAYS 17 HR 20 MIN

(k) -DEPTH (unit depth in meters). The data element is an integer value used in conjunction with AT WIDTH. Example:

AT WIDTH 1250 -DEPTH 1525

(l) DESIRED. No data element.

(m) DIRECT SUPPORT OF UNIT (UID of supported unit). The data element is an eight-character alphanumeric unit identification beginning with B or R. Example:

DIRECT SUPPORT OF UNIT B1212AAR

(n) FACILITY (facility identification code). The data element is a six-character mnemonic, the first three characters being alphabetic and the last three numeric. Example:

FACILITY BFX103

(o) FOR (a specified period of time). The data element is a time group as defined above. The following examples are equivalent:

FOR 200
FOR 2 HOURS
FOR 120 MIN

(p) GENERAL SUPPORT. No data required.

(q) GENERAL SUPPORT-REINFORCING UNIT (UID of the reinforced unit) The data element is an eight-character alphanumeric unit identification beginning with B or R. Example:

GENERAL SUPPORT-REINFORCING UNIT R1234TKB

(r) GO TO (label of procedure statement). GO TO is a pseudo order used to direct the sequence of unit procedure statements applicable to a unit. The data element is an alphanumeric character string of one to three characters. In the following example, the labeled statement is also shown.

GO TO A12.
A12: STAY FOR 3 HRS.

(s) HEIGHT OF BURST (height index). The data element is an integer value 0, 1, 2, 3, 4. Zero is used for a nuclear fire event in which height of burst of the munition and fuze may be specified. Where munition and fuze permit only preset heights of burst, the integer 1, 2, 3, 4 is an index to the preset height option desired, as defined through Nuclear Assessment Model constant data. Example:

HEIGHT OF BURST 2

(t) IMPACT RADIUS (desired height of nuclear burst in meters) The data element is an integer. It is acted upon only in the case of a nuclear munition and fuze which allows specification of height of burst, in which case the data element is the desired height of burst in meters. Example:

IMPACT RADIUS 500M

(u) IN BATTLE (battle identification). The data element is composed of no more than eight alphanumeric characters. Examples:

IN BATTLE EIGHTCHR
IN BATTLE X
IN BATTLE 1PLUS2

(v) MANDATORY. No data required.

(w) MIX (an airmobile aircraft mix index). The data element is an integer. Example:

MIX 3

(x) MUNITION TYPE (weapon/munition code). The data element is a four-character code, the first character being A (conventional round), N (nuclear round), or D (atomic demolition munition). Examples:

A012
NKX3

(y) NUMBER OF AIRCRAFT (specified number of aircraft). The data element is an integer. Example:

NUMBER OF AIRCRAFT 4

(z) NUMBER OF ESCORTS (specified number of escort aircraft). The data element is an integer. Example:

NUMBER OF ESCORTS 6

(aa) NUMBER OF ROUNDS (specified number). The data element is an integer. Example:

NUMBER OF ROUNDS 187

(bb) NUMBER OF TRIPS (specified number of airmobile lift trips). The data element is an integer. Example:

NUMBER OF TRIPS 2

(cc) NUMBER OF VOLLEYS (specified number). The data element is an integer. Example:

NUMBER OF VOLLEYS 1

(dd) ON (location). The data element is a single rectangular map coordinate entry of the form integer - integer. Each integer can be one to seven digits in length. If fewer than seven digits are used, leading zeros are assumed by the compiler. Example:

ON 1163590 - 1246780

(ee) OVER (location or list of locations). A map coordinate pair or list of as many as eight pairs may be entered. Each pair has the form integer - integer, where each integer can be one to seven digits in length; leading zeros are assumed if fewer than seven digits are used. Each location is to the nearest meter. Examples:

OVER 163590 - 246780
OVER 163590 - 246780, 163600 - 246800

(ff) PRIORITY (movement or engineer priority). The data element is one of the integer values 1, 2, 3 or 4. Example:

PRIORITY 4

(gg) REINFORCING UNIT (UID of reinforced unit). The data element is composed of eight alphanumeric characters, the first of which must be B or R. Example:

REINFORCING UNIT B1212123

(hh) STOP TASK (barrier or facility identification). The data element consists of three alphabetic and three numeric characters. Example:

STOP TASK MNA017

(ii) TARGET NUMBER (target index from intelligence report). The data element is an integer. Example:

TARGET NUMBER 480003

(jj) TO (location or list of locations). A map coordinate pair or list of pairs may be entered. Each pair has the form integer - integer, where each integer can be one to seven digits in length; leading zeros are assumed if fewer than seven digits are used. Each location is to the nearest meter. Examples:

TO 163590 - 246780
TO 163590 - 246780, 163600 - 246800

(kk) TYPE (a unit type designator). The data element is composed of four alphabetic characters. Example:

TYPE BAMT

(ll) UNIT (a unit identification). The data element consists of eight alphanumeric characters, the first of which is B or R. Example:

UNIT B1212123

(mm) UNTIL (a specified time). The data element is a time group as described above. Examples:

UNTIL 021215
UNTIL 02 DAYS 12 HOURS 15 MINUTES

4. DSL CONDITIONAL CLAUSES:

a. General. Conditional clauses are used to specify the user's desired sequence of order execution when that sequence depends on conditions prevailing prior to execution of an order or during or upon termination of an order currently being executed. Conditional clauses can be used in Unit Scenarios and in Battle Paragraphs. As with order clauses, the construction of a conditional clause is governed by the allowed vocabulary and the DSL syntax.

b. Conditional Clause Vocabulary. A limited vocabulary is used in the construction of conditional clauses. This vocabulary, together with four possible types of data entries, constitutes the totality of symbols recognized by the DSL Compiler in processing conditional clauses. The vocabulary elements can be arranged within 14 distinct groups, of which groups 1, 12, 13, and 14 are data entries:

Group Number	Description	Legal Vocabulary
1	Unit identification	A UID consisting of eight alpha-numeric characters, the first of which is B or R.
2	Unit's possession	CLASS 3, CLASS 5, PRESENT STRENGTH
3	Unit's possession with data	EQUIPMENT TYPE XXX (an equipment item code)
4	Clock time	TIME
5	Logical operator	GREATER THAN, LESS THAN, EQUAL TO
6	Negator	NOT
7	Unit's activity	ASSESSED, FIRING, MOVING, STOPPED
8	Weather condition	CLOUD COVER, FOG INDEX, RELATIVE HUMIDITY, TEMPERATURE, TEMPERATURE GRADIENT, VISIBILITY INDEX, WIND DIRECTION, WIND SPEED, PRECIPITATION INDEX
9	Location of weather condition	AT LOCATION
10	Unit's activity with data	HALTED AT, AT LOCATION
11	Percent indicator	PERCENT
12	Location data	A pair of seven-digit map coordinates; e.g., 0122000-0095750.
13	Quantity data	An integer.
14	Time data	Formats as presented in subparagraph 3c(2).

c. Conditional Clause Syntax. Syntax established for the DSL Compiler allows seven conditional clause types, where a clause type is a set sequence of elements from the conditional clause vocabulary groups. The types are listed below with one example of each type. Parentheses indicate a group is optional.

Type	Pattern	Example
A	1 2 (6) 5 13 (11)	B1234567 PRESENT STRENGTH GREATER THAN 150
B	1 3 (6) 5 13	B1234567 EQUIPMENT TYPE 172 LESS THAN 34
C	1 8 (6) 5 13 (11)	B1234567 VISIBILITY INDEX NOT LESS THAN 5
D	8 9 12 (6) 5 13 (11)	CLOUD COVER AT LOCATION 0123500-0095000 NOT GREATER THAN 70 PERCENT
E	4 (6) 5 14	TIME GREATER THAN 011300
F	1 (6) 7	B1234567 NOT MOVING
G	1 (6) 10 12	B1234567 AT LOCATION 0123000-0095800

d. Description of Conditions being Tested:

(1) Conditional Type A. The unit for which the test is made may be any resolution unit defined within the system. The quantity against which a check is made is the quantity present in the specified unit of personnel (PRESENT STRENGTH); Class 3, or equipment item 2 (CLASS 3); ammunition associated with individual weapons, or equipment item 6 (CLASS 5). If PERCENT is used, the quantity against which a check is made is the ratio of the amount present in the unit to amount authorized. Examples:

B1234567 CLASS 3 NOT LESS THAN 2500
B1234567 CLASS 5 GREATER THAN 70 PERCENT
B1234567 PRESENT STRENGTH LESS THAN 150

(2) Conditional Type B. The unit for which the test is made may be any resolution unit defined within the system. The item on which the check is to be made is specified by an equipment item code between 1 and 200. The quantity against which a check is made is the quantity present in the unit or, if PERCENT is used, the ratio of quantity present to authorized quantity. Example:

B1234567 EQUIPMENT TYPE 32 LESS THAN 500
B1234567 EQUIPMENT TYPE 3 LESS THAN 50 PERCENT

(3) Conditional Type C. The value against which a check is made is the current weather condition at the location of the specified unit. Legal values of the data entry depend on the weather condition being checked. The values which are treated as percentages are so indicated.

(a) Cloud Cover. The data value can be an integer from 1 to 100. It is treated as a percentage. Example:

B1234567 CLOUD COVER LESS THAN 50 PERCENT

(b) Fog Index. The data value can be 0 (no fog) or 1 (fog). PERCENT is not allowed. Limitation to the logical operators EQUAL TO and NOT EQUAL TO is suggested. Example:

B1234567 FOG INDEX EQUAL TO 1

(c) Relative Humidity. The data value must be between 1 and 100. It is treated as a percentage. Example:

B1234567 RELATIVE HUMIDITY NOT LESS THAN 60 PERCENT

(d) Temperature. The data entry should be desired temperature in degrees Fahrenheit. Example:

B1234567 TEMPERATURE LESS THAN 32

(e) Temperature Gradient. The data value may be 1 (inversion), 2 (moderate inversion), 3 (neutral), or 4 (lapse). Example:

B1234567 TEMPERATURE GRADIENT LESS THAN 3

(f) Visibility Index. The data entry may range from 1 to 9 where 9 denotes best and 1 denotes poorest visibility. Example:

B1234567 VISIBILITY INDEX NOT LESS THAN 6

(g) Wind Direction. The data value, denoting azimuth in degrees, may range from 0 to 360. Example:

B1234567 WIND DIRECTION NOT LESS THAN 45

(h) Wind Speed. The data entry is wind speed in knots. Example:

B1234567 WIND SPEED NOT LESS THAN 12

(i) Precipitation Index. The data entry may have a value of 0 (no precipitation), 1 (light precipitation), or 2 (heavy precipitation). Example:

B1234567 PRECIPITATION INDEX EQUAL TO 0

(4) Conditional Type D. The value against which a check is made is the current weather condition at the specified location. Rules are identical to those for conditional type C.

(5) Conditional Type E. The value within the clause is any legal time format as described in subparagraph 3c(2). This is checked against current time. Example:

TIME GREATER THAN 011330

(6) Conditional Type F. The condition checked is the current status of the specified unit as follows:

(a) ASSESSED. A unit is sensed as ASSESSED if it has been attrited by the Area Fire or Air Ground Engagement Models within the past 15 minutes. Example:

B1234567 NOT ASSESSED

(b) FIRING. A unit is sensed as FIRING if it has received a DSL FIRE order or a TACFIRE fire mission and has not yet completed the ordered fire mission. Example:

B1234567 FIRING

(c) MOVING. A unit is sensed as MOVING if it has received one of the following orders and has not reached the final movement coordinates: MOVE, FLY, ADVANCE, WITHDRAW. If, however, the order is ADVANCE or WITHDRAW and the unit has actually engaged in ground combat, it is not sensed as moving. Example:

B1234567 MOVING

(d) STOPPED. The STOPPED condition is exactly equivalent to NOT MOVING, and MOVING is exactly equivalent to NOT STOPPED.

(7) Conditional Type G. The condition checked is whether the specified location is within the rectangular area defined by the specified unit's current location, orientation, width, and depth. The specified unit must be a resolution unit. Example:

B1234567 NOT AT LOCATION 0123000-0095000.

5. CONTROL CARDS AND DECK STRUCTURE. This paragraph presents control cards required by the DSL Compiler, structure of the DSL Compiler data deck, and structure of decks for submittal to the data processing facility.

a. Compiler Control Cards:

(1) The DSL Compiler call card must be the first card of the data deck. This card has one of the following forms:

DSL.

DSL, DEBUG.

Position on the punched card is not critical, as any blanks are ignored; however, the first entry must be DSL, and the designated comma and period must appear as indicated. Use of the DEBUG option causes the tables generated by the DSL compiler to be listed.

(2) The start of period card must be the second card of the data deck. This card has the form:

START OF PERIOD: XX DAY XX HOUR XX MINUTE.

where XX represents an appropriate numeric entry such as:

START OF PERIOD: 01 DAY 18 HOUR 30 MINUTE.

Presence of the colon and period as illustrated is crucial. To indicate the start of a game, the card must appear as follows:

START OF PERIOD: 01 DAY 00 HOUR 00 MINUTE.

This card indicates the game time at which the period for which DSL orders are being supplied is to start.

(3) The period length card must be the third card of the data deck. This card must be of the form:

PERIOD LENGTH: XXXX MINUTES.

where XXXX represents an appropriate numeric entry such as:

PERIOD LENGTH: 480 MINUTES.

The colon and period must appear as indicated. This card indicates the length of the period of combat to be simulated using the DSL orders.

(4) The final card of the DSL data deck must contain, in any position on the card, the notation:

FINIS.

This card indicates the end of the DSL data deck.

(5) Comments may be inserted at any position in the data deck following the third card. The comment is used to provide background elaboration of the operations being ordered for the information of any individual who should have access to the DSL data deck or a listing thereof. Comments have no meaning to the DSL Compiler or to any other processor of the DSL system and exist solely for user convenience. A comment must be introduced by one of the phrases COMMENT:, CONCEPT:, or CONCEPT OF OPERATION:, where the colon is an integral part of the phrase. A comment is ended with a period. The body of a comment, between the introductory phrase and closing period, may contain any symbol except a period. One comment may be of any length up to (and including) 400 nonblank characters. A DSL data deck may contain as many comments as desired. Example:

COMMENT: SECOND BRIGADE SHOULD NOW BE IN ATTACK POSITIONS; 1ST BN ON NORTH, 2ND BN ON SOUTH AND 3RD BN IN RESERVE (EAST) PD SUPPORTING ARTILLERY (1ST AND 3RD OF 307TH) HAVE FIRED PREPARATORY MISSIONS AND GONE TO TACFIRE MODE.

b. Data Deck Structure. The DSL data deck contains four segments as illustrated in Figure B-2.

(1) The first segment of a DSL data deck must comprise the compiler call card, start of period card, and period length card, in that sequence.

(2) Unit Scenarios comprise the second segment of a DSL data deck. The order in which individual Unit Scenarios appear is not critical, although review may be facilitated by keeping scenarios for units of the Red force and Blue force separate. A Unit Scenario is acted upon only if the specified unit is a resolution unit or has a personnel strength of at least one. Scenarios for nonresolution units are ignored, unless the unit should attain resolution status as the result of an appropriate transfer activity order (DETACH) within the scenario of another unit. In this case, execution of the scenario commences when resolution status is attained. The exception is a scenario with identification ID:REDFORCE. or ID:BLUEFORC. which contains all engineer activity orders for the appropriate force. Comments may appear within any Unit Scenario.

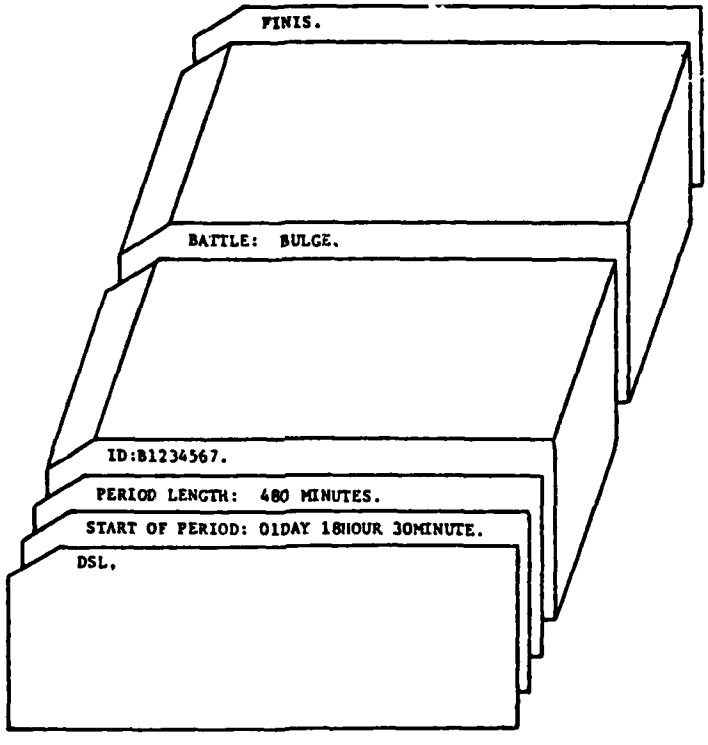


Figure B-2. DSL Data Deck Structure

(3) Battle Paragraphs comprise the third segment of a DSL data deck. All units listed in battle declaration cards of Battle Paragraphs must be provided Unit Scenarios which contain appropriately labeled commands keyed to the battle conditionals as discussed in subparagraph 2c. Situations may arise where a DSL data deck having no Battle Paragraphs is appropriate, which is allowed by the compiler.

(4) The final segment of a DSL data deck is the FINIS. card.

6. DSL RULES AND TECHNIQUES. The DIVWAG Scenario Language provides the gamer with a wide degree of latitude in controlling simulated units within the DIVWAG system. Proper use of DSL does, however, depend upon observation of the basic vocabulary and syntax rules of the language. Effective use also depends upon an appreciation of the model's response to the various orders. This paragraph restates some of the more critical basic DSL rules and provides selected guidelines toward effective DSL writing techniques. As with any language, an individual's facility with DSL strongly depends upon the extent of his exposure to and experience with the language. Thus, fluency with DSL cannot be expected simply by exposure to this manual. It is gained through practice.

a. Elementary Rules:

(1) Unit Scenarios:

(a) A Unit Scenario can be acted upon only if the unit is a resolution unit and has personnel. The DSL Compiler will accept Unit Scenarios for any unit, as long as the scenario is identified with a legal UID. The DIVWAG Period Processor, however, will ignore orders for units not defined within the game, for nonresolution units, and for resolution units having no personnel.

(b) A Unit Scenario may be provided for a nonresolution unit and that unit may gain a resolution status through appropriate use of the DETACH order given to another unit. When this happens, the Unit Scenario is acted upon at the time resolution status is gained.

(c) If a unit loses resolution status, through the JOIN order in its own Unit Scenario or through an order to DETACH its last subordinate; or should a unit lose all personnel; it will not execute any remaining orders in its Unit Scenario.

(d) A unit may have only one Unit Scenario. Presence of more than one Unit Scenario for a given unit causes the tables generated by the DSL Compiler to be invalidated.

(e) A Unit Scenario must contain at least one command.

(f) Liberal use of labels within a Unit Scenario is a key to efficient use of DSL. Labels must, however, be unique within a Unit Scenario. The sequence of orders cannot be followed as the user intends if more than one command has the same label in one Unit Scenario.

(2) Battle Paragraph/Unit Scenario Interface:

(a) Each unit listed in the battle declaration card must be provided a Unit Scenario.

(b) Within the Unit Scenario for each unit listed in the battle declaration card, properly labeled commands must appear.

b. Basic DSL Techniques:

(1) Timing. It is generally possible to control the time at which execution of an order begins by preceding the order with a STAY order or a PREPARE order. In the following example, the STAY order is used to time a FIRE order and a MOVE order.

```
ID:B1111111.
STAY UNTIL 010530.
FIRE MUNITION TYPE A003 ON 0123000-0123000
  NUMBER OF VOLLEYS 4 IMPACT RADIUS 100.
STAY UNTIL 010615.
MOVE TO 0118000-0127000.
```

(2) Repetitive Orders. It is generally possible to repeat a sequence of orders using the GO TO order with appropriate labels. In the following example, an artillery unit is ordered to fire upon a series of three targets repetitively. A time conditional is used to exit the loop when time exceeds 021800.

```
ID:B11111FA.
STAY UNTIL 021630.
A1:FIRE MUNITION TYPE A003 ON 0123000-0123000
     NUMBER OF VOLLEYS 3 IMPACT RADIUS 100.
FIRE ON 0118000-0123000 MUNITION TYPE A003
     NUMBER OF VOLLEYS 3 IMPACT RADIUS 100.
FIRE ON 0120000-0122525 NUMBER OF VOLLEYS 2
     MUNITION TYPE A003 IMPACT RADIUS 100.
IF TIME NOT GREATER THAN 021800, THEN GO TO A1.
STAY UNTIL 022000.
```

(3) Skipping Commands. Judicious use of conditionals with the GO TO order permits skipping a command or series of commands as the situation may dictate. In the example B123BN01 will engage in one of two battles depending upon the strength of B123BN02. The command with label ABC will be executed upon termination of either battle (Battle Paragraphs not shown here).

```
ID:B123BN01.
PREPARE UNTIL 020500.
IF B123BN02 PRESENT STRENGTH LESS THAN 125, THEN
     GO TO AAA.
ADVANCE TO 0125000-0113000.
ENGAGE IN BATTLE BIGHORN.
AAA:ADVANCE TO 0120000-0115500.
ENGAGE IN BATTLE FIREFITE.
ABC:PREPARE UNTIL 021200.
```

c. Techniques Related to Models:

(1) Ground Combat Model. Preparation of DSL commands for the Ground Combat Model is the most subtle phase of DSL preparation. Functioning of the model must be held in mind as orders are prepared.

(a) Battle is initiated in response to an ADVANCE order followed by an ENGAGE order. Initiation requires scheduling the first Ground Combat Model assessment cycle to take place 15 minutes from the time of initiation. Initiation takes place only if a unit on the other force is currently under a PREPARE or a WITHDRAW order and is within 3000 meters (front to front) of the unit receiving the ENGAGE order.

(b) Assessment of battle results takes place at the scheduled time. Assessment will cover all units under ADVANCE, PREPARE, or WITHDRAW orders at the time of assessment. Only units under an appropriate order and within 3000 meters of an opponent who is also under an appropriate order are treated. Specification of attacker and defender within the Ground Combat Model is determined by the one unit in whose scenario the ENGAGE order that caused initiation occurs. All units on the initiator's side are assessed as attackers and all units on the opposing side are assessed as defenders.

(c) Upon completion of the assessment cycle, all conditionals in the Battle Paragraph are checked to determine if the battle must be terminated. If none of the conditions are met, another assessment cycle is scheduled to take place in 15 minutes.

(d) A battle may be reinitiated at any time another ENGAGE order is encountered. Once initiated and terminated, a battle will generally terminate 15 minutes after reinitiated. This is because reinitiation will schedule a 15-minute cycle, and the conditional that terminated the battle the first time will generally continue to be true and will generally terminate the battle each time it is reinitiated.

(e) Upon battle termination, all units listed in the Battle Paragraph will progress to labeled commands as indicated by the battle conditional that is met. This occurs regardless of whether the units actually participated in the battle. The command under execution at the time of battle termination is not generally completed.

(f) Battle conditionals are checked in the order in which they appear in the Battle Paragraph. Once a condition is met, later conditionals are not checked. Thus, if several conditions are included, the condition expected to occur at the latest time should generally appear first in the Battle Paragraph.

(2) Reconnaissance Orders. The reconnaissance control code is of paramount importance in a RECONNOITER order. The code consists of four characters, $C_1C_2C_3C_4$, where the first character, C_1, identifies the mission type as light observation helicopter mission (C_1=H), light fixed wing aircraft mission (C_1=F), Mohawk OV-1D type aircraft mission (C_1=M), or Air Force reconnaissance mission (C_1=A). Meaning of successive characters of the code depends upon the first character.

(a) Control Code Determination:

1. LOH/Fixed Wing Observation Reconnaissance Mission. Code equals H $C_2C_3C_4$ or F $C_2C_3C_4$.

a. If the second character, C_2, is R, then the mission is a route reconnaissance mission; otherwise, it is an area reconnaissance mission. If it is an area reconnaissance mission, then C_2 has values 1-9, where the integer value specifies the time assigned to the search area in units of 15-minute intervals. For example, a code of H326 specifies an area reconnaissance mission lasting 45 minutes for an LOH.

b. The third character, C_3, has a range of 0-9 and specifies the route deviation limit in kilometers (corridor width) which the aircraft will not exceed during the flight. In the example, H326, the character 2 in the third position specifies that the LOH will reconnoiter along routes with a corrider width of 2 kilometers, and thus will never exceed the 1-kilometer deviation limit from the route interval. For an area reconnaissance mission, the third character is used in the same manner and effectively creates a density of reconnaissance coverage; i.e., successive passes over the assigned area will be separated by the corridor width.

c. The fourth character, C_4, ranges from 1-9 and is used for two purposes:

- C_4 is the sensor load combination code which identifies the list of sensor types carried on board the aircraft
- C_4 is also the combination code which identifies the correct LOH decision control matrix to use in this mission. Note that the same sensor load is required to use the same decision matrix; however, with up to 10 combinations

available, it is possible to list the same sensor load with different decision matrices.

2. Mohawk Type Mission. Code equals M $C_2C_3C_4$.

a. This type reconnaissance mission is currently restricted to represent only the SLAR MTI with GST and camera sensor types on board. The fourth character, C_4, identifies the sensor load combination carried on board in the same manner as the LOH. The first sensor type in the combination is currently restricted to the SLAR MTI with GST.

b. The second character, C_2, is used to set the range and delay of the SLAR MTI sensor package during the RECONNOITER order flight path. The allowed values of C_2 and interpretations are shown in Figure B-3 where the values of DELAY, RANGE 1, RANGE 2, and RANGE 3 are set as part of the constant data base.

Second Character of code	SLAR MTI Settings	
	Delay Setting	Range Setting
C_2 = 0	0 x DELAY	RANGE1
C_2 = 1	1 x "	"
C_2 = 2	2 x "	"
C_2 = 3	3 x "	"
C_2 = 4	4 x "	"
C_2 = 5	5 x "	"
C_2 = 6	6 x "	"
C_2 = A	0 x DELAY	RANGE2
C_2 = B	1 x "	"
C_2 = C	2 x "	"
C_2 = D	3 x "	"
C_2 = E	4 x "	"
C_2 = F	5 x "	"
C_2 = Z	0 x DELAY	RANGE3

Figure B-3. Delay and Range Settings for Mohawk Type Mission

c. The third character, C_3, defines the direction(s) for which the SLAR is gated as being to the right, left, or to both sides of the aircraft flight direction as follows:

. C_3 = R, radar is gated on the right side only

. C_3 = L, radar is gated on the left side only

. C_3 = B, radar is gated on both sides

3. Air Force Aircraft Reconnaissance Mission. Code equals A X X C_4.

a. The second and third characters of the code are not currently used by the submodel and should contain X X.

b. The fourth character, C_4, is used to specify the sensor load combination on board as in previous mission types. (Sensor types are currently restricted to camera systems.)

(b) DSL Flight Pattern Data:

1. The DSL order also specifies the flight intervals or area over which the reconnaissance mission is to be flown. The coordinate endpoints listed on the DSL order form the actual flight path taken in Mohawk OV-1D and Air Force reconnaissance missions.

2. If the mission is an area reconnaissance mission, the coordinates specify the four corners of the area over which the reconnaissance mission is to be flown. The order of the points appearing in the DSL order is such that $P_1P_2P_3P_4$ are in counterclockwise order around the enclosed reconnaissance area. Also P_1P_2 is the rear boundary from which the reconnaissance aircraft will start the coverage of the area.

3. If the DSL order request is for an LOH type mission, the actual flight path does not follow the route intervals exactly but remains within the corridor limits defined in the DSL order control code.

7. DIVWAG SCENARIO LANGUAGE VOCABULARY. Figure B-4 and Figure B-5 provide a compendium of the DSL order and modifier vocabulary in tabular form.

a. DSL Orders. Figure B-4 lists the DSL order, the appropriate modifiers--required, exclusive, and optional--for that order, and the code number.

b. DSL Order Modifiers. Figure B-5 lists the modifiers of DSL orders with the type and format of data. Various comments are included regarding the data format.

Orders	Required Modifiers	Exclusive Modifiers*	Optional Modifiers	Code Number
ACCEPT TRANSPORT	MIX	NUMBER OF TRIPS NUMBER OF AIRCRAFT	NUMBER OF ESCORTS AT TIME	20
ADVANCE	TO		BY PRIORITY AT WIDTH - DEPTH	6
AIRMOBILE ASSAULT	TO		AT TIME	41
ASSIGNMENT IS		DIRECT SUPPORT OF UNIT REINFORCING UNIT GENERAL SUPPORT GENERAL SUPPORT REINFORCING UNIT		23
ASSUME CONTROL OF	UNIT			24
BREACH		BARRIER, BRIDGE, FACILITY } one of BEGIN BY, COMPLETE BY } one of	PRIORITY, MANDATORY, DESIRED } one of	43
BUILD		BARRIER, BRIDGE, FACILITY } one of BEGIN BY, COMPLETE BY } one of	PRIORITY, MANDATORY, DESIRED } one of	42

Figure B-4. DSL Orders (continued on next page)

Orders	Required Modifiers	Exclusive Modifiers*	Optional Modifiers	Code Number
DETACH	UNIT		TYPE	26
ENGAGE	IN BATTLE			15
FIRE (Conventional)	MUNITION TYPE ON	NUMBER OF ROUNDS NUMBER OF VOLLEYS	IMPACT RADIUS	9
FIRE (Nuclear)	IMPACT RADIUS MUNITION TYPE NUMBER OF ROUNDS 1 ON		HEIGHT OF BURST	9
FIRE ON TARGETS OF OPPORTUNITY		FOR UNTIL		10
FLY	AT ALTITUDE AT SPEED OVER			7
GO TO	(command label)			
JOIN	UNIT			25
LOITER	AT ALTITUDE AT SPEED FOR			32
MISSION IS	AIRCRAFT TYPE NUMBER OF AIRCRAFT TARGET NUMBER		AT TIME	39
MOVE	TO		BY PRIORITY	3

Figure B-4. DSL Orders (continued)

Orders	Required Modifiers	Exclusive Modifiers*	Optional Modifiers	Code Number
PREPARE		FOR UNTIL	AT WIDTH - DEPTH	2
RECONNOITER	AT ALTITUDE AT SPEED BY OVER			8
RELEASE TRANSPORT				31
REMOVE		BARRIER BRIDGE FACILI~. } one of BEGIN BY COMPLETE BY } one of	DESIRED MANDATORY } one of	44
RETAIN	AIRCRAFT TYPE NUMBER OF AIRCRAFT			40
STAY		FOR UNTIL		1
STOP TASK	(barrier/facility identifier)			45
TERMINATE				37
WITHDRAW	TO		BY AT WIDTH - DEPTH PRIORITY	5

* One and only one required.

Figure B-4. DSL Orders (concluded)

Modifier	Data Type	Data Format	Comments
AIRCRAFT TYPE	Equipment item code	One to three digits	
AT ALTITUDE	Height (in feet)	Integer	Integer may be followed by FEET or FT.
AT SPEED	Speed (in knots)	Integer	Integer may be followed by KNOT or KNOTS.
AT TIME	Absolute time	ddhhmm	d = number of days (digit). h = number of hours (digit). m = number of minutes (digit). One to six digit integer. If less than six digit, zero fill on left is assumed.
		dDhHmM	d = number of days (integer). h = number of hours (integer). m = number of minutes (integer). D = DAYS, DAY, or DA H = HOURS, HOUR, or HR M = MINUTES, MINUTE, or MIN dD, hH, or mM (or any two of the three forms) may be omitted (e.g., dDhH is valid). dD, hH, and mM may be arranged in any order (e.g., hHdD is valid). Caution: 0800 HOURS = 800 hours, not eight hours.
AT WIDTH	Unit front (meters)	Integer	

Figure B-5. DSL Order Modifiers (continued on next page)

Modifier	Data Type	Data Format	Comments
BARRIER	Barrier identification code	Alphanumeric string, six characters.	First three characters are alpha, last three numeric.
BEGIN BY	Absolute time	(See AT TIME modifier)	
BRIDGE	Facility identification code	Six alphanumeric characters.	First three characters are alpha, last three numeric.
BY	Transportation mode	Four alphabetic characters.	
BY	Reconnaissance control code.	Four alphanumeric characters.	Used only with RECONNOITER order. First character is A, F, L or M.
COMPLETE BY	Absolute time	(See AT TIME modifier)	
- DEPTH	Unit depth (meters)	Integer	
DESIRED	Not applicable.		
DIRECT SUPPORT OF UNIT	UID	Alphanumeric string	Eight characters beginning with B or R.
FACILITY	Facility identification code	Six alphanumeric characters.	First three characters are alpha, last three numeric.
FOR	Time length	(See AT TIME modifier)	
GENERAL SUPPORT	Not applicable		Used with ASSIGNMENT IS order.

Figure B-5. DSL Order Modifiers (continued)

Modifier	Data Type	Data Format	Comments
GENERAL SUPPORT-REINFORCING UNIT	UID	Alphanumeric string	Eight characters beginning with B or R.
GO TO	Label	Alphanumeric string	Three characters only. One of two orders (not modifiers) requiring data.
HEIGHT OF BURST	Preset HOB option code.	Integer, 0, 1, 2, 3, 4	Used with nuclear FIRE order to indicate which preset HOB when fuzing appropriate.
IMPACT RADIUS	Height of bust (meters)	Integer	Used with nuclear FIRE when fuzing allows specification of HOB. Mandatory for all other FIRE orders but data not used.
IN BATTLE	Battle name	Alphanumeric string	One to eight characters.
MANDATORY	Not applicable.		
MIX	Airmobile transport/ escort mix code.	Integer 1-10	
MUNITION TYPE	Munition mnemonic	Alphanumeric string	Four characters.
NUMBER OF AIRCRAFT	Desired number	Integer	Used with RETAIN, MISSION IS, ACCEPT TRANSPORT orders.
NUMBER OF ESCORTS	Desired number	Integer	Used with ACCEPT TRANSPORT order.

Figure B-5. DSL Order Modifiers (continued)

Modifier	Data Type	Data Format	Comments
NUMBER OF ROUNDS	Rounds	Integer	For nuclear FIRE, must be 1.
NUMBER OF TRIPS	Desired number	Integer	Used with ACCEPT TRANSPORT order.
NUMBER OF VOLLEYS	Volleys	Integer	
ON	Single coordinate pair	x-y, Integer	x and y are integers measured in meters.
OVER	Coordinate pairs	x_1-y_1, ..., x_n-y_n Integer	x_i and y_i are integers measured in meters. $n \leq 8$ except for area reconnaissance, in which case n must be 4.
PRIORITY	Movement or engineer task priority	1, 2, 3 or 4	
REINFORCING UNIT	UID	Character string	Eight characters beginning with B or R
STOP TASK	Barrier or facility identification code.	Six alphanumeric characters.	First three characters are alpha, last three numeric. One of two orders (not modifiers) requiring data.
TARGET NUMBER	Target index from intelligence report.	Five to seven digits.	

Figure B-5. DSL Order Modifiers (continued)

Modifier	Data Type	Data Format	Comments
TO	Coordinate pairs	x_1-y_1, ..., x_n-y_n Integer	x_i and y_i are integers measured in meters. For AIRMOBILE ASSAULT order, $n \leq 4$. For ADVANCE order $n=1$. Otherwise $n \leq 8$.
TYPE	Unit type designator (UTD)	Alphanumeric string	Four characters.
UNIT	Unit identification	Alphanumeric string	Eight characters beginning with B or R.
UNTIL	Absolute time	(see modifier AT TIME)	

Figure B-5. DSL Order Modifiers (concluded)

APPENDIX C

OPERATING INSTRUCTIONS REFERENCE MANUAL

1. INTRODUCTION. The Operating Instructions program of the Orders Input Processor provides a capability to add or update specified operational parameters utilized to control automatic processor occurring within the model prior to each game period. The functions performed by the Operating Instructions program are the following:

Placement and control of ground based sensors
Introduction of intelligence
Establishment of penetration limits
Allocation of close air support sorties.

This appendix provides the procedures for preparing input data for the Operating Instructions program. The four following paragraphs describe the data requirements for each function listed above. The final paragraph contains the procedure for structuring the data deck.

2. SENSOR CONTROL. The DIVWAG system will simulate up to 100 model sensors for each opposing force where a model sensor is an individual moving target indicator (MTI), countermortar/counterbattery (CM/CB), or air defense (AD) radar or an unattended ground sensor (UGS) field. Each such model sensor is defined to the DIVWAG system through the use of the OPERINS loader. A distinct card format is required for each type sensor as discussed below. Certain data items, including a sensor code, unit identification (UID) of first node, sensor index, sensor reference number, and sensor status code are common to all card formats.

a. Data Common to All Sensors:

(1) Sensor Code. Each generic type sensor is identified by a sensor code which appears on all sensor control data cards. Permissible values of this code and interpretations are:

02 = short range MTI radar
03 = medium range MTI radar
04 = long range MTI radar
05 = continuous tracking type CM/CB radar
06 = dual beam type CM/CB radar
07 = UGS field
08 = AD radar.

(b) UID of First Node. Each sensing report is passed, within the Intelligence and Control Model, through an intelligence communications network for decisions and processing. (See Volume II, Section IV, Chapter 6 for a detailed discussion.) Nodes within this network are battalion, brigade, or

division level command units. This entry identifies the unit that is nominally in control of the sensor being specified. Each sensor will use the unit so identified as the entry point into the network for all sensing reports generated by that sensor. The UID is the eight-character alphanumeric unit identifier of the unit to be specified. This unit must have a maneuver type unit type designator (UTD); that is, the third character of this unit's UTD must be M.

(c) Sensor Index. If a given unit (UID) is responsible for more than one MTI radar, more than one CM/CB radar, more than one AD radar, or more than one UGS field, the sensor index is used to determine to which radar or UGS field the OPERINS data applies. A sequence of sensor indexes, starting with 1, must be assigned to each group of model sensors that is composed of elements from one of the above categories and shares the same first node UID. For example, if a given unit controlled three MTI radars, one CM/CB radar, and six UGS fields; the sensor indexes applied to the MTI radar would be 1, 2, and 3; to the CM/CB radar 1; and to the UGS fields 1, 2, 3, 4, 5, and 6.

(d) Sensor Reference Number. Hardware characteristics of each type sensor are defined using the Intelligence and Control Model constant data load routines (see Volume II, Section IV, Chapter 6, Appendix A). These routines assign a reference number to each type sensor. This reference number is used to specify within OPERINS data the piece of hardware desired. The reference number is obtained from the printed output of the Intelligence and Control load routines.

(e) Sensor Status Code. Allowed values of the sensor status code are:

1 = available
2 = tracking
3 = inoperative.

The status code is set dynamically to appropriate values by the Intelligence and Control Model. An entry of 1 using OPERINS data will permit full play of the sensor during the course of the period. An entry of 2 or 3 made by OPERINS is not reset by the Intelligence and Control Model and will effectively turn off the sensor through the course of the period.

b. MTI Radar. The essential hardware characteristics of this type radar are entered in the constant data input. These performance characteristics are not changed during the entire game. The operating instructions, which the gamer is expected to give, are those that deal with operating constraints and changes in the situation as the battle progresses. This card format must be prepared for each sensor played either to define the sensor initially or to change a previously defined sensor's location, status, and orientation. There are two segments in the input card format, illustrated in Figure C-1. The first segment, columns 1 through 18, identifies a specific radar and associates its operating unit with identification details. The second segment, columns 20 through 66, specifies the location and other operating parameters.

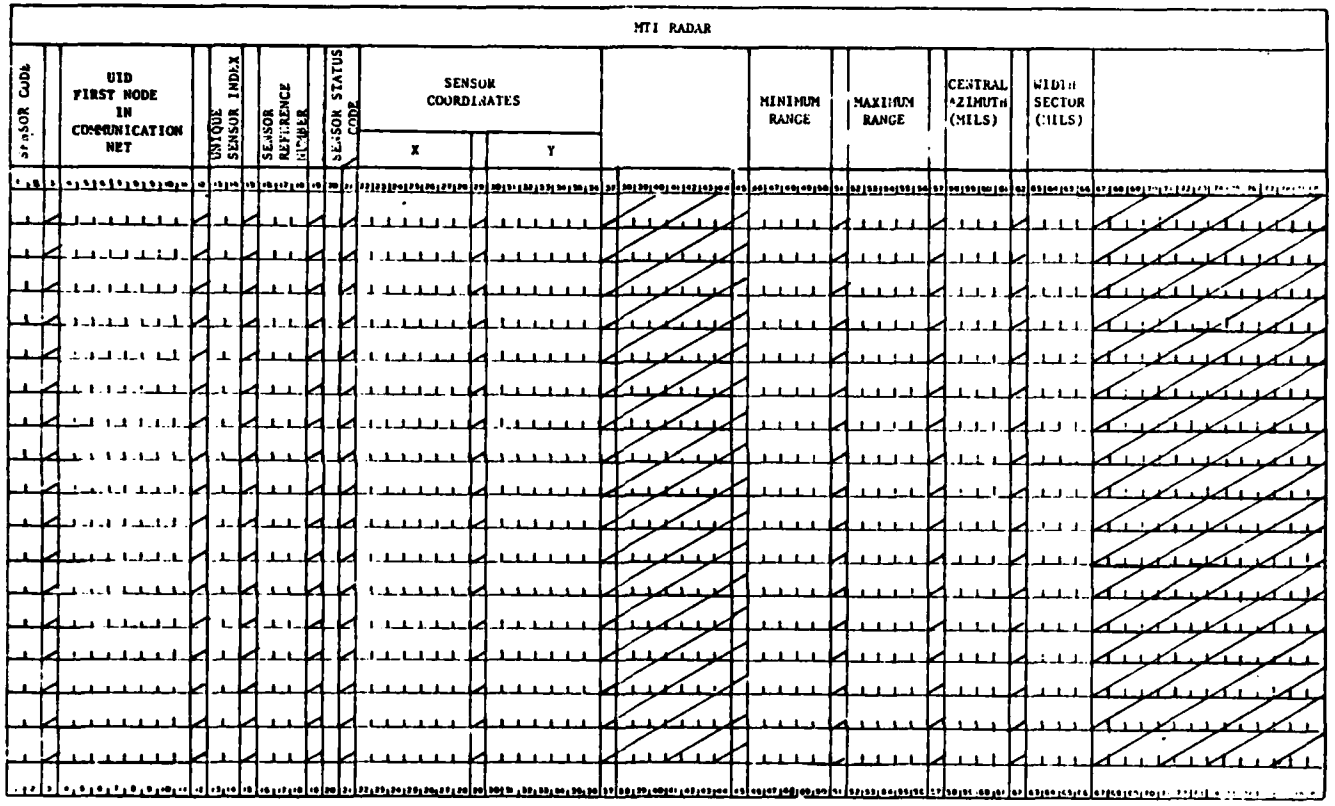


Figure C-1. Moving Target Indicator Radar Card Format

(1) Sensor Code (Columns 1-2). Each generic type sensor is identifi by a sensor code. For MTI radar, enter the value 02 (short range), 03 (medium range), or 04 (long range).

(2) UID of Controlling Unit (Columns 4-11). Enter the eight-character UID of the unit that is to receive reports from this sensor. (This must be a unit having an M as the third character of its UTD.)

(3) Unique Sensor Index (Columns 13-14). When the controlling unit is responsible for more than one MTI radar, this index is used to discriminate among the radars. The index must be assigned serially, starting with 1 for the first MTI radar under this unit, 2 for the next MTI radar, etc. In relocating or reorienting a radar, this index is used to decide which radar to move, should a unit be responsible for more than one. The entry is right justified.

(4) Sensor Reference Number (Columns 16-18). Each specific type of sensor hardware is parametrically defined within the constant data input on the Intelligence and Control Model data file. In the process, a reference number is assigned by the data load program. Enter this number, obtained from the load program's printed output.

(5) Sensor Status Code (Column 20). The status of the radar at the beginning of the game or period is to be entered in this card column.

(6) Sensor Coordinates (Columns 22-36). Enter the seven-digit X and Y coordinates of the sensor right adjusted in appropriate columns. Leading zeros are not required.

(7) Assigned Area of Search (Columns 46-66). The area of search to be assigned to an MTI radar is specified by the entries on columns 46-66. Columns 46-50 and 52-56 contain the minimum and maximum ranges, respectively, of the assigned search area, in meters. Columns 58-61 contain the orientation, or central azimuth, of the assigned search sector, measured clockwise in mils from grid north. Columns 63-66 contain the width of the assigned search sector, in mils. These values must not exceed hardware characteristics as loaded in the Intelligence and Control Model constant data.

c. CM/CB Radar. The hardware characteristics of this type radar were entered in the constant data input. These characteristics are not changed during the entire game. The data on countermortar/counterbattery radar loaded as Operating Instruction are those that deal with operating constraints and changes in the situation as the battle progresses. A card in this format (Figure C-2) must be prepared for each sensor played either to define the sensor initially or to change a previously defined sensor's location status or orientation.

(1) Sensor Code (Columns 1-2). Each generic type sensor is identified by a sensor code. For a single beam continuous tracking CM/CB radar, set the

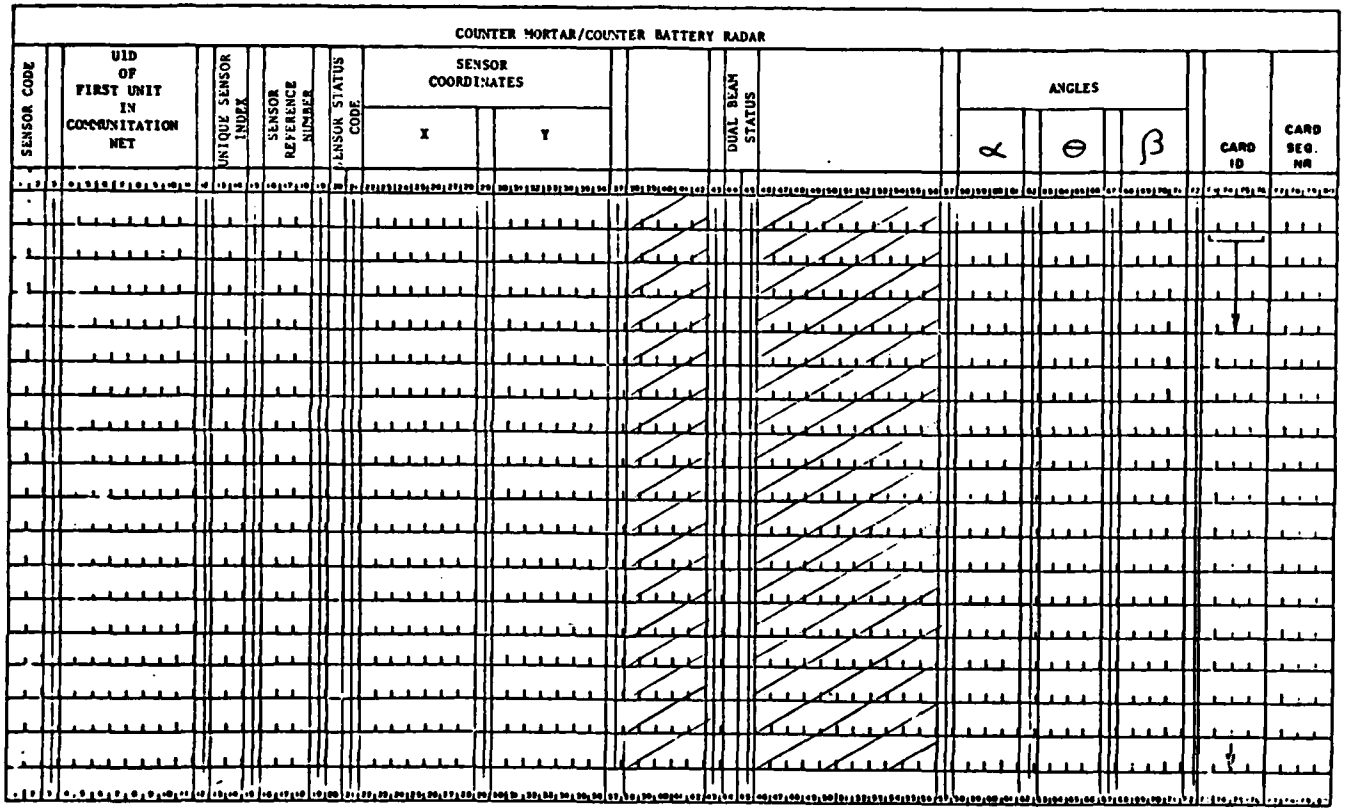


Figure C-2. Countermortar/Counterbattery Radar Card Format

code to 5. For a dual beam CM/CB radar, set the code to 6. The entry must be right justified.

(2) UID of First Node in Communication Net (Columns 4-11). Enter the eight-character UID of the unit that will be the first node in a communication network from this specific radar site. This unit must be a maneuver unit (i.e., have the character M in the third character of the UID).

(3) Unique Sensor Index (Columns 13-14). When this receiving node has more than one CM/CB radar reporting to it, this index is used to discriminate among the radars. The index must be assigned serially, starting with 1 for the first CM/CB radar reporting to this unit, 2 for the second, etc. In relocating or reorienting a radar, this index is used to decide which radar to move or reorient, should the unit have more than one reporting to it. The entry must be right justified.

(4) Sensor Reference Number (Columns 16-18). Each specific type of sensor hardware is parametrically defined within the constant data input on the Intelligence and Control Model data file. In the process, a reference number is assigned by the data load program, and it is this number that is required here to tie this particular radar to a set of hardware data.

(5) Sensor Status Code (Column 20). The status of the radar at the beginning of the game or period is to be entered in this card column. Entering a 2 or 3 will preclude the radar from detecting and recognizing targets during the course of the period. Entering a 1 will permit full play of the radar during the course of the period.

(6) Sensor Coordinates (Columns 22-36). Enter the seven-digit X and Y coordinates of the sensor. The entry must be right justified, and leading zeros are not required.

(7) Dual Beam Status (Column 44). This is a status code for dual beam CM/CB radars only (i.e., sensor code 6). This flag is used to indicate the desired operational status of the radar. Possible entries are:

0 = monitor low angle fire only
1 = monitor high angle fire only
2 = switch back and forth to monitoring low and high angle fire.

The radar must have this capability.

(8) Center Azimuth, α (Columns 58-61). This the orientation or center azimuth of the search sector, measured in mils from grid north. Entry must be right justified.

(9) Search Sector, θ (Columns 63-66). This is the assigned search sector width, in mils. If this search sector is more than two times the

sector coverage capability of the hardware (see beam description variables in Volume II, Appendix A to Chapter 6 of the Period Processor, Section IV for Countermortar/Counterbattery Radars), there will be a coverage gap in the center of the assigned search sector. Entry must be right justified.

(10) Site Mask Angle, β(Columns 68-71). This is the site mask angle measured in mils, and it must be right justified in the field.

d. AD Radar. Hardware characteristics of the radars are entered in the Intelligence and Control Model constant data files (see Volume II, Section IV, Chapter 6, Appendix A). These hardware characteristics are not to be exceeded by those in the Operating Instructions input. The operating instructions that the gamer is expected to provide on AD sensors are those that deal with operating constraints and changes in the situation as the battle progresses. This card format must be prepared for each AD radar to be played. Format of the input card is shown on Figure C-3.

(1) Sensor Code (Columns 1-2). Each generic type of sensor is identified by a sensor code. For AD radar, enter the value 08.

(2) UID of First Node in Communication Net (Columns 4-11). Enter the eight-character UID of the unit that will be the first node in a communication network from this specific radar site. This unit must be a maneuver unit (i.e., have the character M in the third character of the UTD).

(3) Unique Sensor Index (Columns 13-14). When this receiving node has more than one AD radar reporting to it, this index is used to discriminate among the radars. The index must be assigned serially, starting with 1 for the first AD radar reporting to this unit, 2 for the second, etc. In relocating or reorienting a radar, this index is used to decide which radar to move or reorient, should the unit have more than one reporting to it. The entry must be right justified.

(4) Sensor Reference Number (Columns 16-18). Each specific type of sensor hardware is parametrically defined within the constant data input on the Intelligence and Control Model data file. In the process, a reference number is assigned by the data load program, and it is this number that is required here to tie this particular radar to a set of hardware data.

(5) Sensor Status Code (Column 20). The status of the radar at the beginning of the game or period is to be entered in this card column. Entering a 2 or 3 will preclude the radar from detecting and recognizing targets during the course of the period. Entering a 1 will permit full play of the radar during the course of the period.

(6) Sensor Coordinates and Height (Columns 22-44). Enter the seven-digit X, Y coordinates and height in meters of the sensor right adjusted in the appropriate columns. Leading zeros are not required.

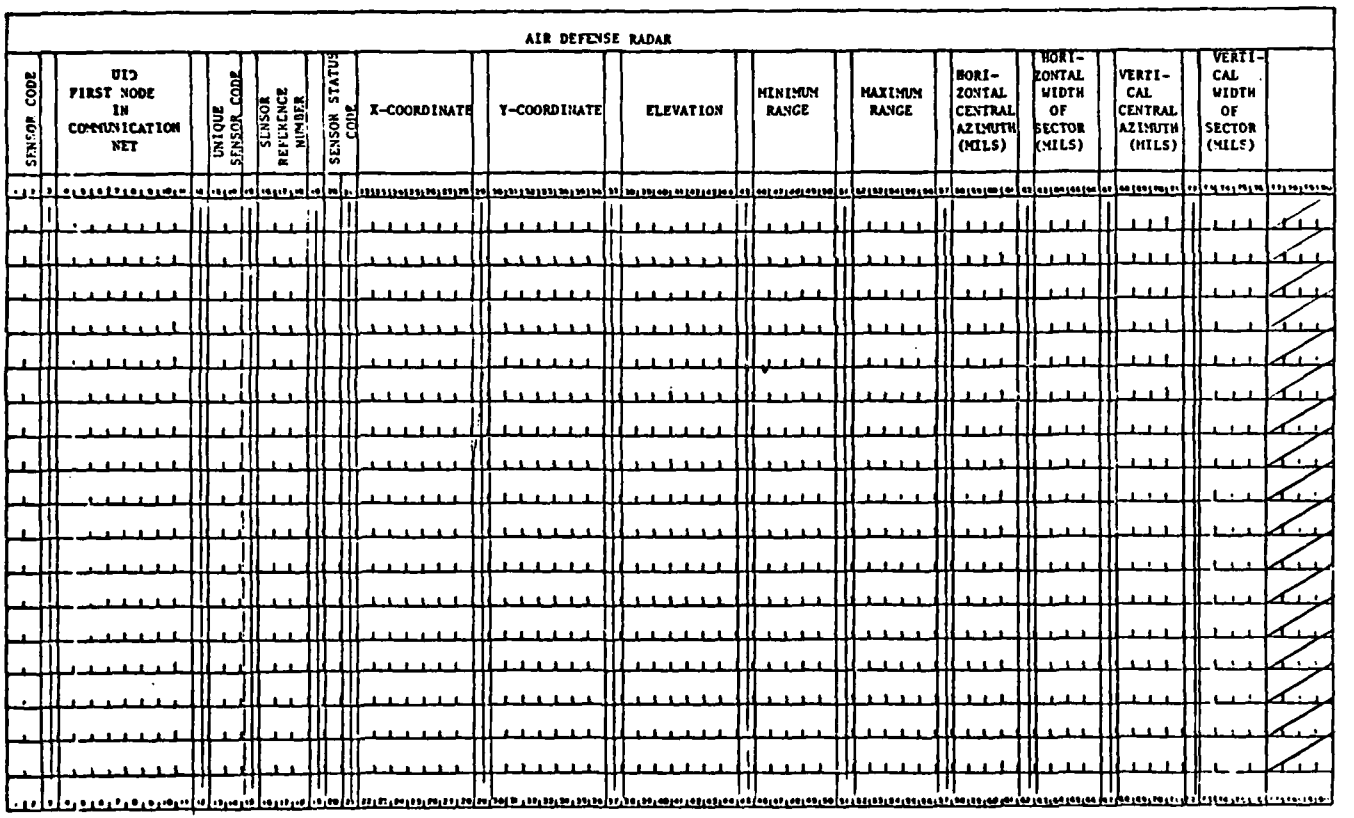


Figure C-3. Air Defense Radar Card Format

(7) Assigned Area of Search (Columns 46-76). The area of search to be assigned to an AD radar is specified by the entries in columns 46-76. Columns 46-50 and 52-56 contain the minimum and maximum ranges, respectively, of the assigned search area, in meters. Columns 58-61 contain the orientation, or central azimuth, of the assigned search sector, measured in mils clockwise from grid north. Columns 63-66 contain the width of the assigned search sector, in mils. Columns 68-71 contain the vertical central azimuth of the search area, in mils. Columns 73-76 contain the width of the vertical search sector, in mils.

e. Unattended Ground Sensors. This section describes the card formats required to represent unattended ground sensor fields. Each UGS field requires three data cards. The first card contains data necessary to identify the UGS field, the second card specifies the composition of the UGS field, and the third card specifies the location of the field. The format of each of these cards is discussed below.

(1) UGS Identification (Figure C-4). This card specifies the sensor code, UID of the controlling unit, unique sensor index, sensor status, and the median time to track and report enemy units.

(a) Sensor Code (Columns 1-2). Each generic type of sensor is identified by a sensor code. For UGS fields, enter the value 07.

(b) UID of First Node in Communication Net (Columns 4-11). Enter the eight-character UID of the unit that will be the first node in a communication network from this specific UGS field. This unit must be a maneuver unit (i.e., have the character M in the third character of the UTD).

(c) Unique Sensor Index (Columns 13-14). When this receiving node has more than one UGS field reporting to it, this index is used to discriminate among the fields. The index must be assigned serially, starting with 1 for the first UGS field reporting to this unit, 2 for the second, etc.

(d) Sensor Status Code (Column 20). The status of the UGS field at the beginning of the game or period is to be entered in this card column. Entering a 2 or 3 will preclude the field from detecting and recognizing targets during the course of the period. Entering a 1 will permit full play of the field during the course of the period.

(e) Median Time to Track and Detect (Columns 39-44). Enter the median time in seconds, from activation of this UGS field to receipt of a sensing report at the first communication node.

(2) UGS Field Composition (Figure C-5). This card specifies the composition of the UGS field. Field composition is defined in terms of the number of each distinct type of UGS that is located within the field. Up to 10 different types of UGSs may be present in a given field. See Volume II, Section IV, Appendix A to Chapter 6, for a discussion of UGS types.

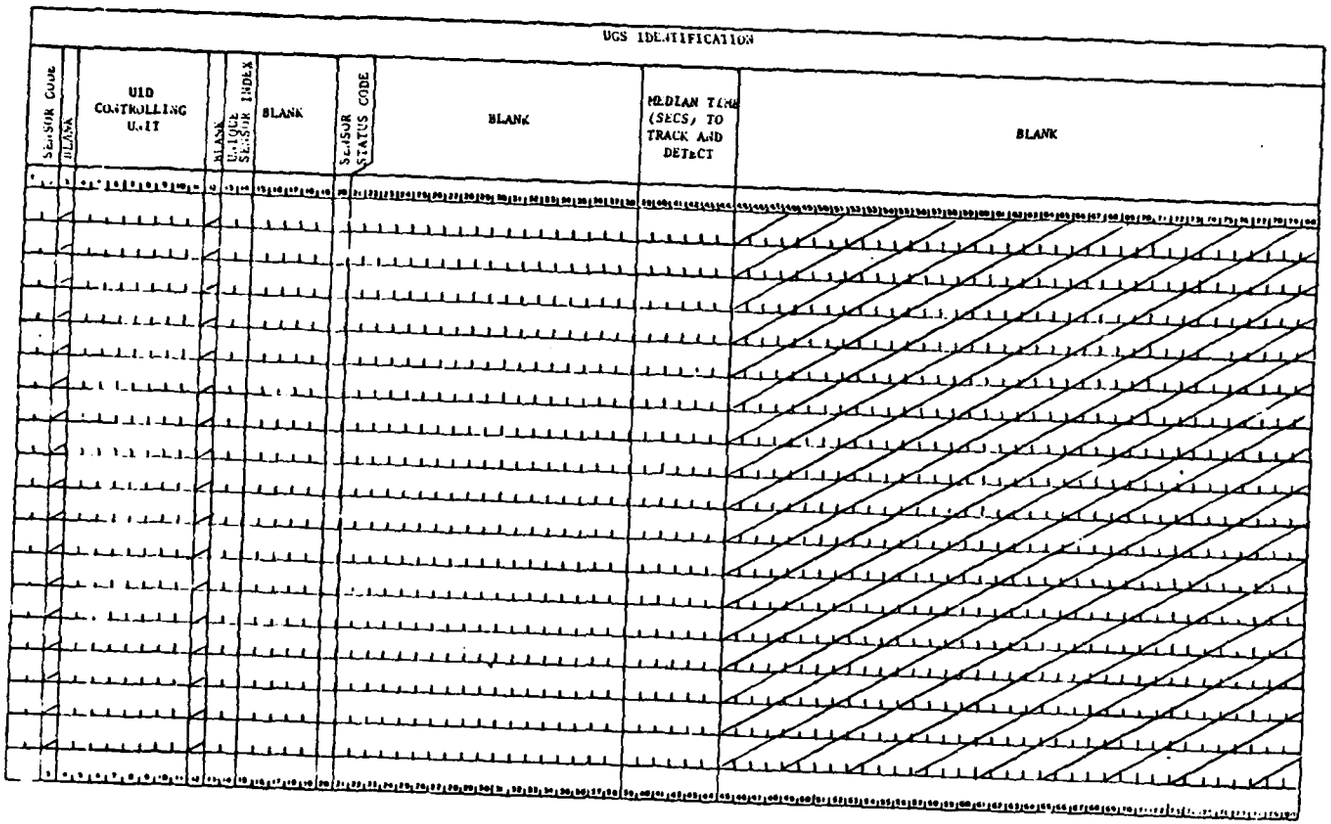


Figure C-4. Unattended Ground Sensor Identification Card Format

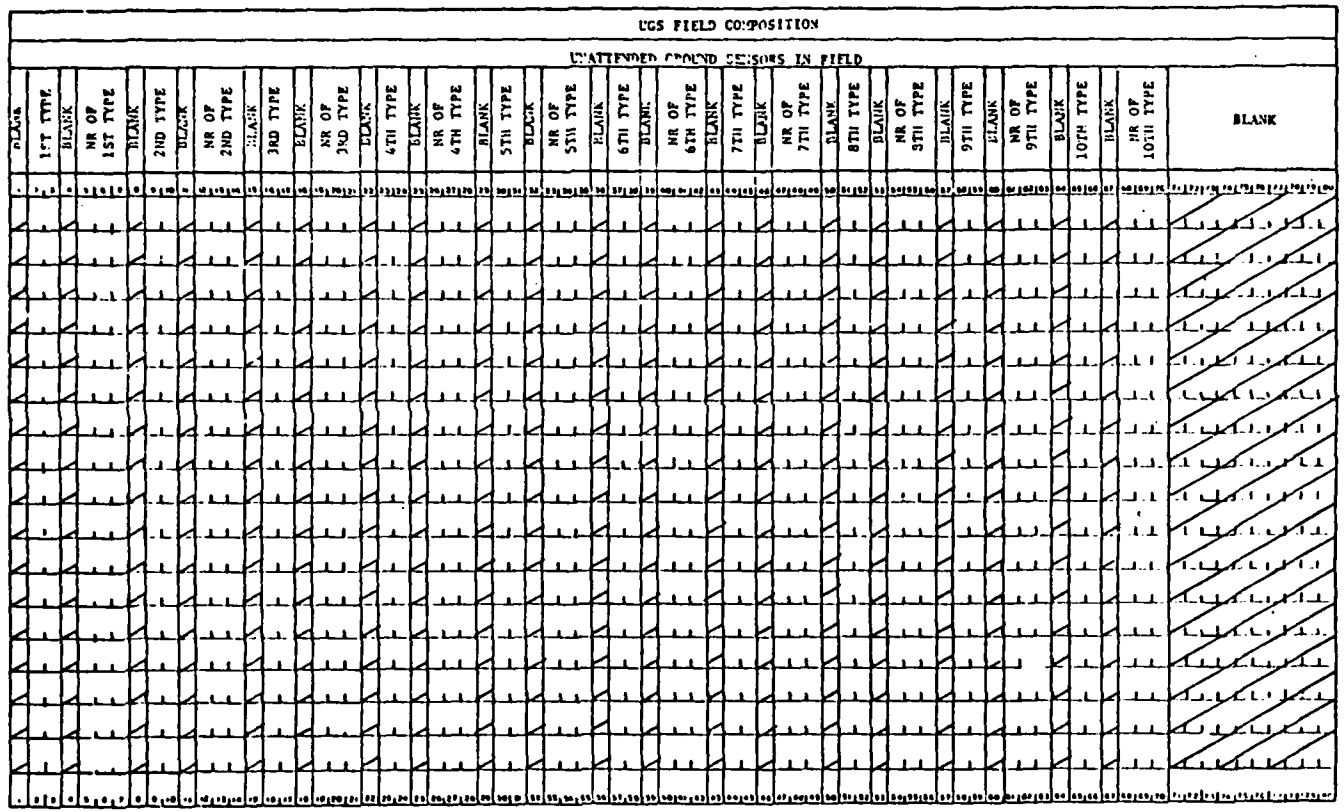


Figure C-5. Unattended Ground Sensor Field Composition Card Format

(a) Sensor Type (Columns 2-3). The sensor type identifies the specific kind of UGS. This sensor type must agree with the definition given in the UGS constant data (Volume II, Section IV, Chapter 6).

(b) Number (Columns 5-7). Enter the number of sensors, of the type specified above, to be placed in the UGS field.

(c) The remainder of the card has space for defining nine additional sensor types and their numbers.

(3) UGS Field Location (Figure C-6). This card specifies the battlefield locations of the UGS field by listing the four corner coordinates of the field. The shape of an UGS field is restricted to a convex quadrilateral. A geometric figure is said to be convex if it is possible to connect any two points in the figure by a straight line that lies entirely within the figure. The geometric figure shown as (a) below (Figure C-7) is convex; the figure shown as (b) is not. The order in which the corners are input is arbitrary.

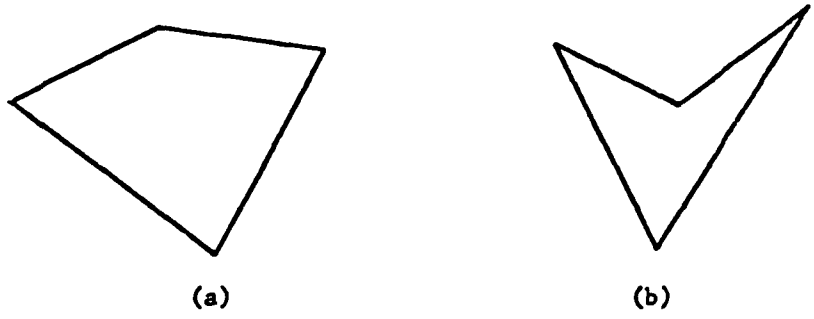


Figure C-7. Geometric Figures

(a) X coordinate (Columns 2-8). Enter the seven-digit X coordinate of the first corner of the field. Leading zeros are not required.

(b) Y coordinate (Columns 10-16). Enter the seven-digit Y coordinate of the first corner of the field.

(c) The remainder of the card contains the coordinates of the remaining three corners.

3. INTRODUCTION OF INTELLIGENCE. While the DIVWAG Period Processor simulates a range of ground-based and aerial sensors generally available to a division in the field, explicit simulation of all potential sources of battlefield intelligence is not attempted. The ability is available through the OPERINS

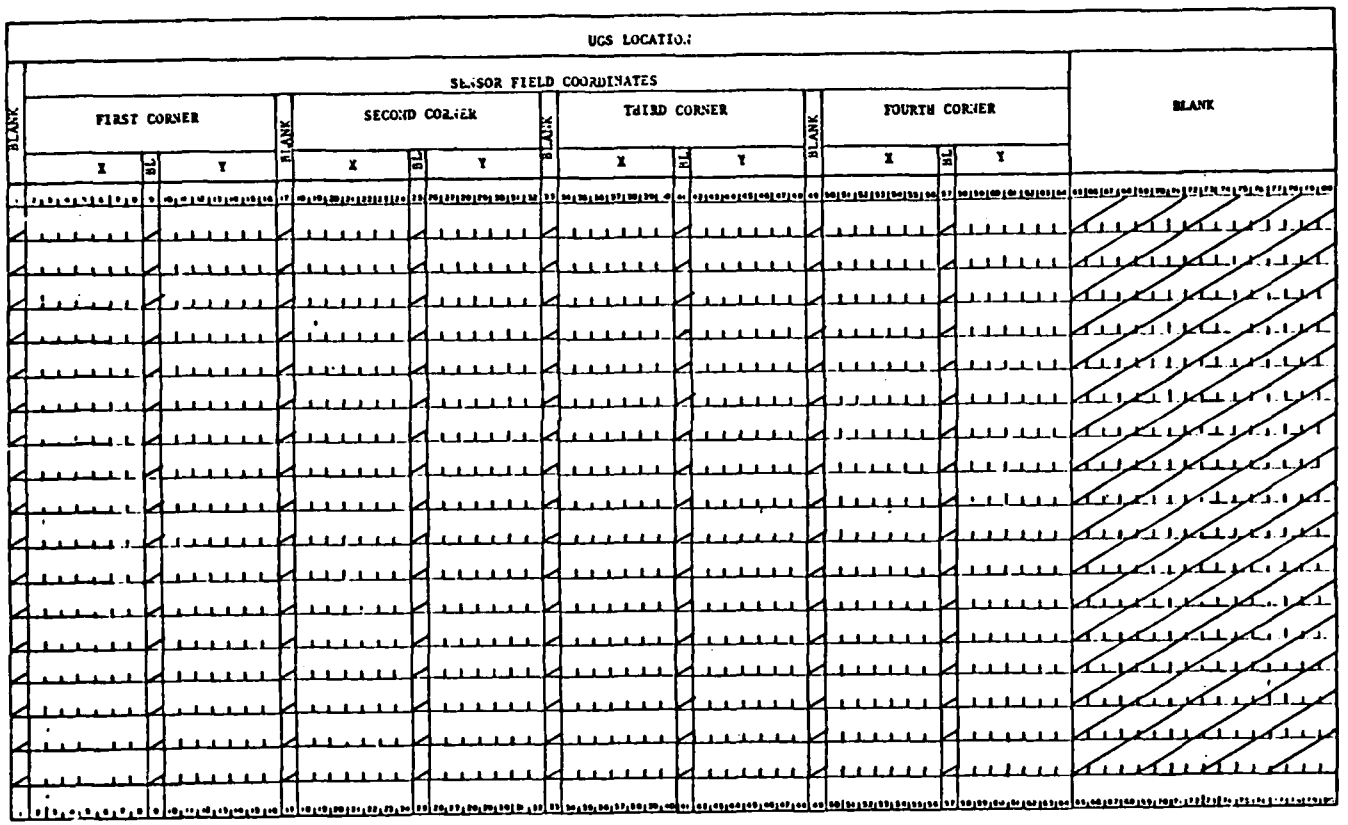


Figure C-6. Unattended Ground Sensor Location Card Format

loader to introduce additional intelligence to the model. This capability is intended to permit the control team to enrich the intelligence picture available to the opposing player teams in a closed or semi-closed game while maintaining the information within the format that is generally used for intelligence in the DIVWAG system. It also permits specification of targets for attack within the Air Ground Engagement Model or for automatic allocation of fire support, should this prove necessary. In all cases, use of this feature should be stringently controlled by the game's control team.

a. Approach. Intelligence introduced to the DIVWAG Period Processor through the OPERINS loader enters and is processed by the Intelligence and Control Model similarly to intelligence gathered by sources explicitly modeled. The data input by the OPERINS loader is formatted to produce a sensing report similar to those generated within the model. The input data format permits the user to control the time at which this sensing report enters the Intelligence and Control Model, the node in the intelligence communication network at which the sensing report enters the system, and whether the report passes through the intelligence processing portions of the model, the fire support allocation portions of the model, or both. Details of the Intelligence and Control Model communications network, processing, and fire support allocation logic are found in Volume II, Section IV, Chapter 6.

b. Card Formats. Three card formats are prescribed for the introduction of intelligence with the OPERINS loader. The period card is prepared only once for each game period in which intelligence is introduced. For each sensing report to be introduced, one intelligence information card and one estimated equipment card are produced.

(1) Period Card. The period card, illustrated in Figure C-8, is the first data card of an intelligence data deck processed by the OPERINS loader. The information provided on this card is needed to correctly schedule time of entry of sensing reports into the Intelligence and Control Model. The symbols PERIOD, DAY, HOUR, MINUTE and a period are preprinted on the coding form at columns 1-6, 12-14, 19-22, 27-32, and 33 respectively and must be punched on the data card. Data to be provided are the starting time of the game period for which intelligence is to be introduced. Start of period in terms of day, hour, and minute are placed in columns 9-10, 16-17, and 24-25, respectively. Each entry is right justified.

(2) Intelligence Information. This card format, shown in Figure C-9, is the first of two cards requred for each item of intelligence to be introduced into the system.

(a) Source Type Code (Columns 1-2). The source type code is a gamer or control group classification of the information source. Within the model, its function is simply one of mechanical bookkeeping; and processing of each sensing report is identical, regardless of the nature of the information source specified. Legal codes and their nominal source interpretation are:

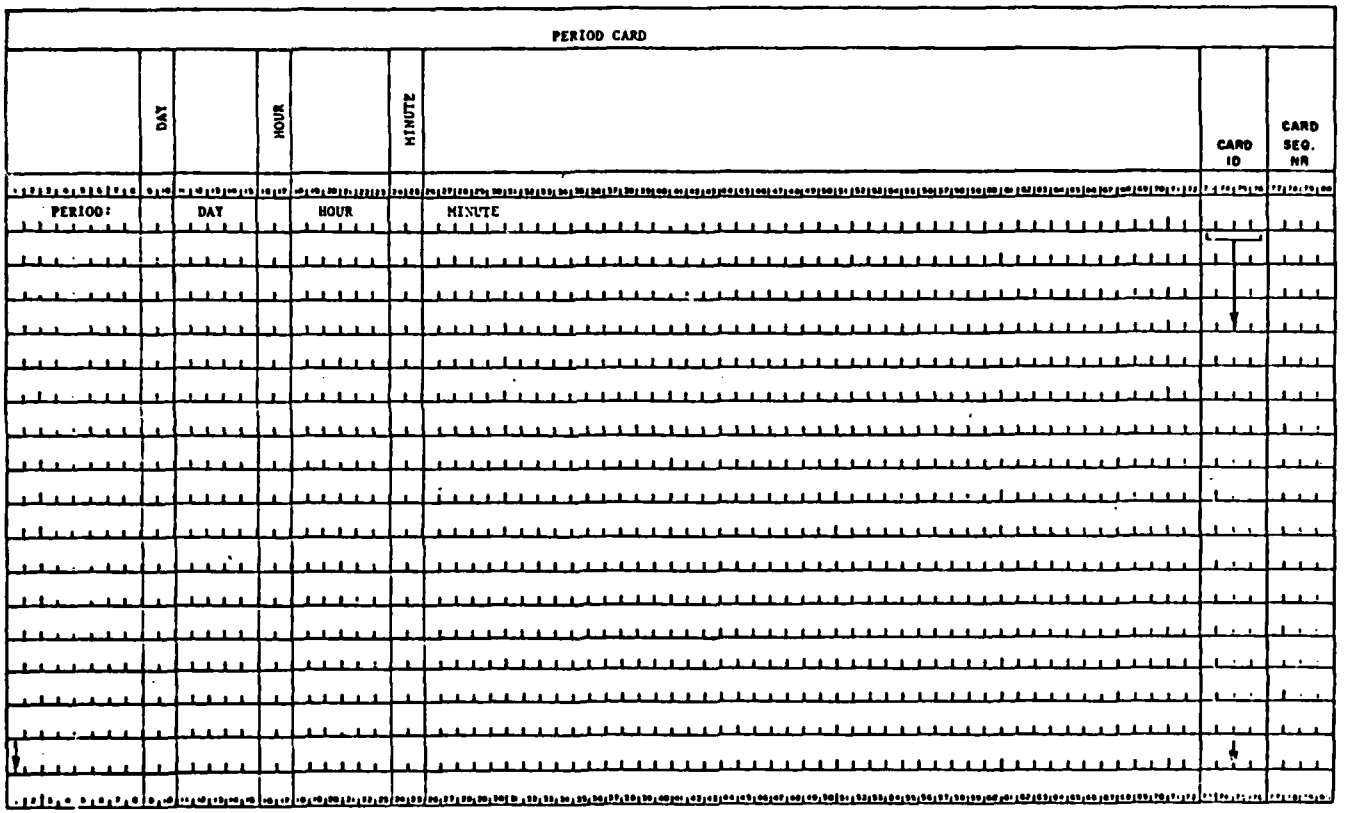


Figure C-8. Period Card Format

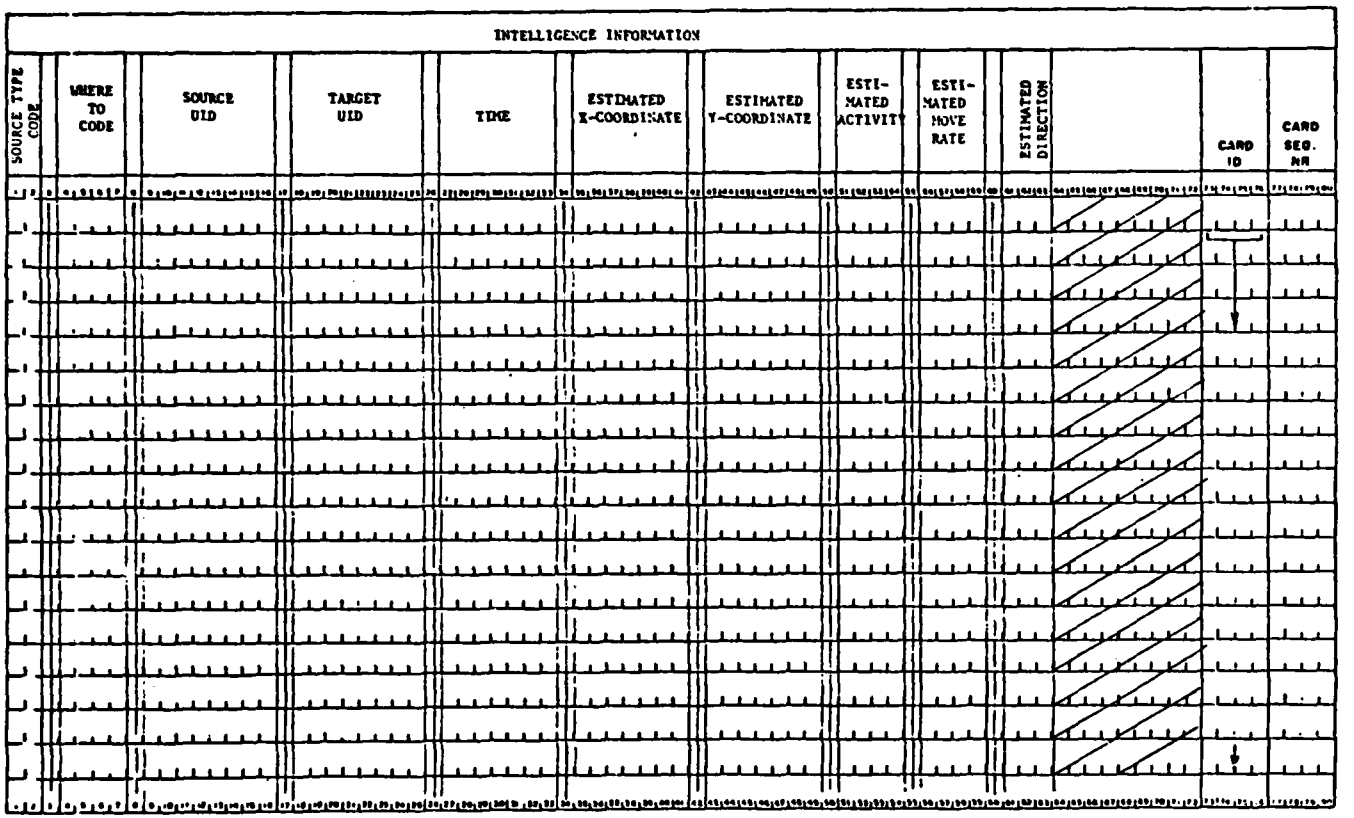


Figure C-9. Intelligence Information Card Format

31 = Prisoners of war
32 = Civilians
33 = Recovered military personnel
34 = Captured enemy documents
35 = Enemy materiel
36 = Stay-behind units
37 = Agencies for operation behind enemy lines
38 = Other sources.

(b) Where to Code (Columns 4-7). This code establishes the type of action to be taken upon the sensing report within the Intelligence and Control Model. Legal codes and indicated actions are:

- INTL - Enter report only in intelligence processing and communication net
- FSCC - Enter report only in the fire support allocation logic of the model
- BOTH - Enter report both in intelligence processing and communication net and in fire support allocation logic.

(c) Source UID (Columns 9-16). Enter the eight-character alphanumeric UID of a unit to whom the information is first available. This unit will function as the first node in the communication network for the sensing report and must be a battalion, brigade, or division-level maneuver unit.

(d) Target UID (Columns 18-25). Enter the eight-character alphanumeric UID of the target unit; i.e., the unit described by this report.

(e) Time (Columns 27-33). Enter the time at which the information is to enter the Intelligence and Control Model. Upon entry the report is processed as any sensing report in the model, and the user must be aware of decision and processing delay times that will be applied. Enter the day in columns 27-28, the slash (/) in column 29, and the time (24-hour clock) in columns 30-33. For example, 02/0830 represents 0830 hours on the second day of simulated combat.

(f) Estimated Location (Columns 35-49). Enter the seven-digit X and Y coordinates of the estimated location of the target unit. Entries are right justified in columns 35-41 (X coordinate) and 43-49 (Y coordinate) and leading zeroes may be omitted.

(g) Estimated Activity (Columns 51-54). The estimated activity of the target unit at time of entry of the report into the system is required. Legal activity codes for the unit are:

MOVE = Unit moving
FIRT = Unit firing tube artillery
FIRM = Unit firing missile artillery
FIRA = Unit firing air defense weapons
ATCK = Unit in an attack posture
DEFN = Unit in a defensive posture
WTHD = Unit withdrawing
ENGR = Unit involved in engineering activity
STAY = Unit stationary and not otherwise active.

(h) Estimated Move Rate (Columns 56-57). If the estimated activity is MOVE, ATCK, or WTHD, enter the estimated rate of unit movement in meters per minute; otherwise, leave the field blank.

(i) Estimated Direction (Columns 61-63). If the estimated activity is MOVE, ATCK, or WTHD, enter the estimated direction of movement; otherwise, leave the field blank. Directions are expressed as points of the sixteen-point compass, and entries are right justified within the field. Legal entries are:

N	E	S	W
NNE	ESE	SSW	WNW
NE	SE	SW	NW
ENE	SSE	WSW	NNW

(3) Estimated Equipment. This card format, shown in Figure C-10, is the second of two cards required for each item of intelligence to be introduced into the system. This information is used within the model to develop estimated type and size of the target unit.

(a) Personnel (Columns 1-4). Estimated number of personnel obtained from source.

(b) Vehicles (Columns 6-8). Estimated number of vehicles, other than those in categories described below, obtained from source.

(c) Tanks (Columns 10-12). Number of tanks estimated by source about the target.

(d) APCs (Columns 14-16). Estimated number of APCs in target obtained from source.

(e) Artillery Tubes (Columns 18-20). Number of artillery tubes estimated by information source.

(f) Artillery Missiles (Columns 22-24). Estimated number of artillery missiles in target.

(g) Air Defense Guns (Columns 26-28). Number of AD guns estimated by source to be in target unit.

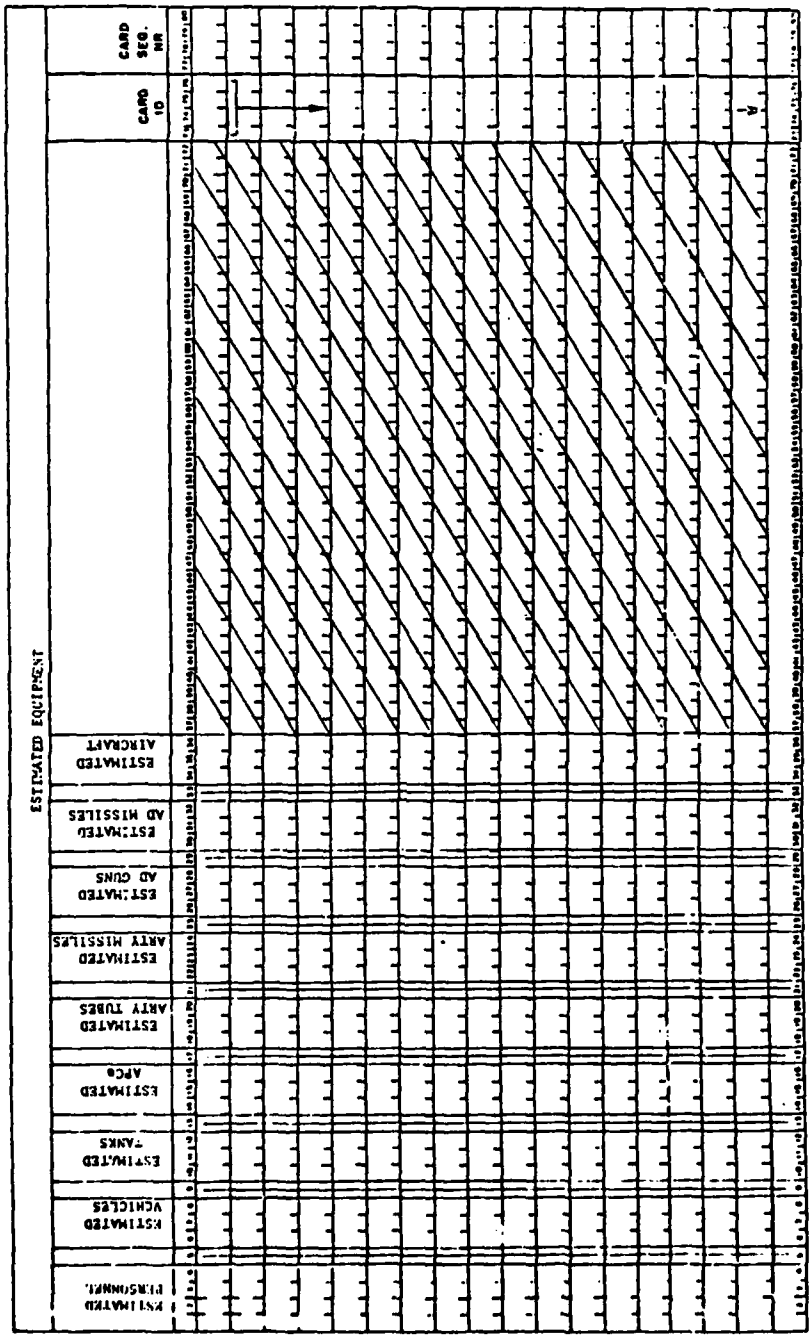


Figure C-10. Estimated Equipment Card Format

(h) Air Defense Missiles (Columns 30-32). Estimated number of AD missiles in target unit.

(i) Aircraft (Columns 34-36). Estimated number of aircraft obtained from information source.

4. HELICOPTER AND ARTILLERY PENETRATION LIMITS. This card format, shown at Figure C-11, sets limiting ranges beyond which helicopter and artillery fire support missions will not be requested by the fire support allocation logic of the Intelligence and Control Model. Ranges are stated in terms of distance beyond the FEBA. The Period Processor actually calculates a rectilinear approximation of the trace of the FEBA to be used in reaching fire support allocation decisions. Since the model's approximation of the FEBA may not coincide with the FEBA on game maps plotted by the user, the calculation of the model FEBA, as described in Volume II, Section IV, Chapter 5, should be understood prior to assignment of these ranges. The user should be aware that ranges are initially set to zero within the model and should be set to desired values at the first game period.

a. Blue Helicopters (Columns 2-7). Enter in meters the maximum range beyond the FEBA to which Blue attack helicopter missions may be automatically requested within the model.

b. Blue Artillery (Columns 9-14). Enter in meters the maximum range beyond the FEBA to which Blue artillery fire missions may be automatically reqeusted within the model.

c. Red Artillery (Columns 16-21). Same definition as columns 9-14.

5. CLOSE AIR SUPPORT SORTIES. These card formats are used to set the number of TACAIR sorties available to the Blue and Red forces. They are initialized at zero and must be set by OPERINS data to obtain TACAIR simulation.

a. Blue Sortie Constraints (Figure B-12). It is assumed that all Blue sorties will be conducted by all-weather-capable aircraft. Sorties are allocated in 6-one hour blocks, starting at midnight; and unused sorties in one block are not carried over to later blocks. Entries are the maximum number of sorties available from 0001 to 0600 (columns 1-5); from 0601 to 1200 (columns 6-10); from 1201 to 1800 (columns 11-15); and from 1801 to 2400 (columns 16-20).

b. Red Sortie Constraints (Figure B-13). Both all-weather-capable aircraft and aircraft limited to good visibility conditions are played for Red. The good visibility aircraft are flown first, conditons and sortie limits permitting; otherwise, allocation of sorties is as for Blue TACAIR. Enter maximum Red all-weather-capable sorties for the time blocks 0001 to 0600; 0601 to 1200; 1201 to 1800; and 1801 to 2400 in columns 21-25; 26-30; 31-35 and 36-40 respectively.

6. OPERINS DATA DECK STRUCTURE. The data deck for the OPERINS loader is composed of up to four subdecks. Any or all of these decks may be provided

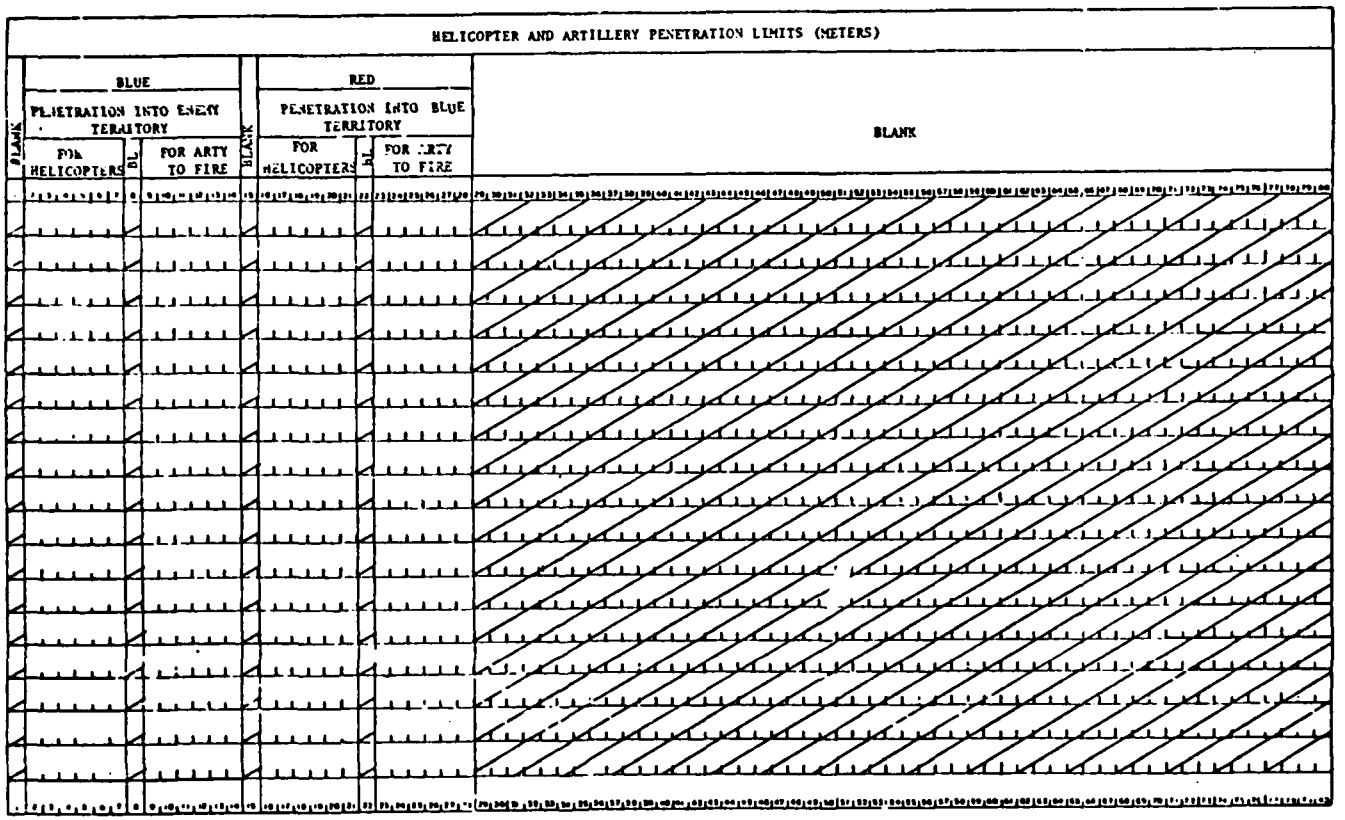


Figure C-11. Helicopter and Artillery Penetration Limits Card Format

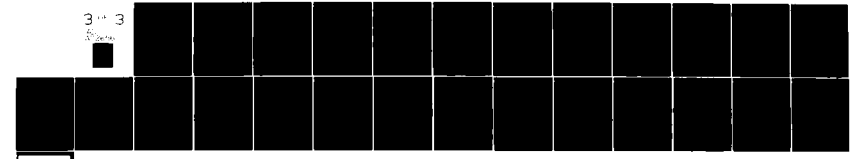
BLUE SORTIES				
MAXIMUM NUMBER OF ALL WEATHER SORTIES FOR EACH 6 HOUR PERIOD STARTING AT MIDNIGHT				BLANK
PERIOD 1	PERIOD 2	PERIOD 3	PERIOD 4	

Figure C-12. Card Format for Blue Sorties

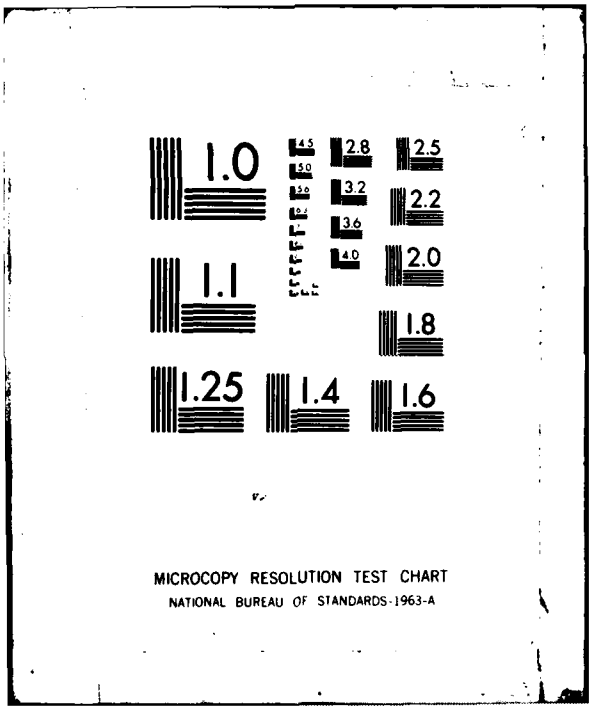
RED SORTIES								
MAXIMUM NUMBER OF ALL WEATHER SORTIES FOR EACH 6 HOUR PERIOD STARTING AT MIDNIGHT				MAXIMUM NUMBER OF GOOD VISIBILITY SORTIES FOR EACH 6 HOUR PERIOD STARTING AT MIDNIGHT				BLANK
PERIOD 1	PERIOD 2	PERIOD 3	PERIOD 4	PERIOD 1	PERIOD 2	PERIOD 3	PERIOD 4	

Figure C-13. Card Format for Red Sorties

AD-A112 656 ARMY COMBINED ARMS COMBAT DEVELOPMENTS ACTIVITY FORT--ETC F/G 15/7
DIVWAG MODEL DOCUMENTATION. VOLUME III. PLANNER/USER MANUAL.(U)
JUL 76
UNCLASSIFIED CACDA-TR-8-76-VOL-3 NL



END
DATE FILMED
4 82
DTIC


1.0
1.1
1.25
1.4
1.6
1.8
2.0
2.2
2.5
2.8
3.2
3.6
4.0
MICROCOPY RESOLUTION TEST CHART
NATIONAL BUREAU OF STANDARDS-1963-A

for one operation of the loader. Each subdeck is introduced by a header card with the proper code punched in the first two columns. Legal header card codes and associated subdecks are:

01 Sensor control subdeck
02 Introduction of intelligence subdeck
03 Helicopter and artillery penetration subdeck
04 Close air support sorties subdeck.

a. Subdeck Structure:

(1) Sensor Control Subdeck. The first card of the sensor control subdeck is a header card with the symbols 01 punched in the first two card columns. Following the header card, sensor control data cards may be provided in any sequence with the requirement that the three cards required to establish an UGS field must be contiguous and in the order presented in Paragraph 11e (UGS Identification, UGS Field Composition, UGS Field Location) for each UGS field. The user should bear in mind the limit of 100 model sensors (radars or UGS fields) per force. The size of this subdeck is not fixed; and the last card of the subdeck must be a blank card, used to signal the end of the subdeck to the loader.

(2) Introduction of Intelligence Subdeck. The first card of this subdeck must be the header card with the symbols 02 punched in the first two card columns. The second card of this subdeck must be the Period Card, described in Paragraph 3b(1). For each sensing report to be introduced into the system, the Intelligence Information Card must be followed immediately by the Estimated Equipment Card. There is no practical limit on the number of such card pairs to be processed. The size of this subdeck is not fixed; and the last card of the subdeck must be a blank card, used to signal the end of the subdeck to the loader.

(3) Helicopter and Artillery Penetration Subdeck. This subdeck consists of the header card, with 03 punched in the first two card columns, followed by one data card as discussed in Paragraph 4.

(4) Close Air Support Sorties Subdeck. This subdeck is composed of a header card, with 04 punched in the first two card columns, followed by a Blue Sortie Card, followed by a Red Sortie Card. All three cards must be present in the proper order.

b. Deck Structure. Only those subdecks required for the game period need be included in the data deck. The order of subdecks within the data deck is of no significance as long as each subdeck starts with the proper header card. An end of data deck card, with 99 punched in columns 1-2 of the card, must follow the last subdeck. A typical data deck is shown in Figure C-14.

c. Control Cards. The instructions for preparing the control cards and work request form are contained in Appendix A of this volume.

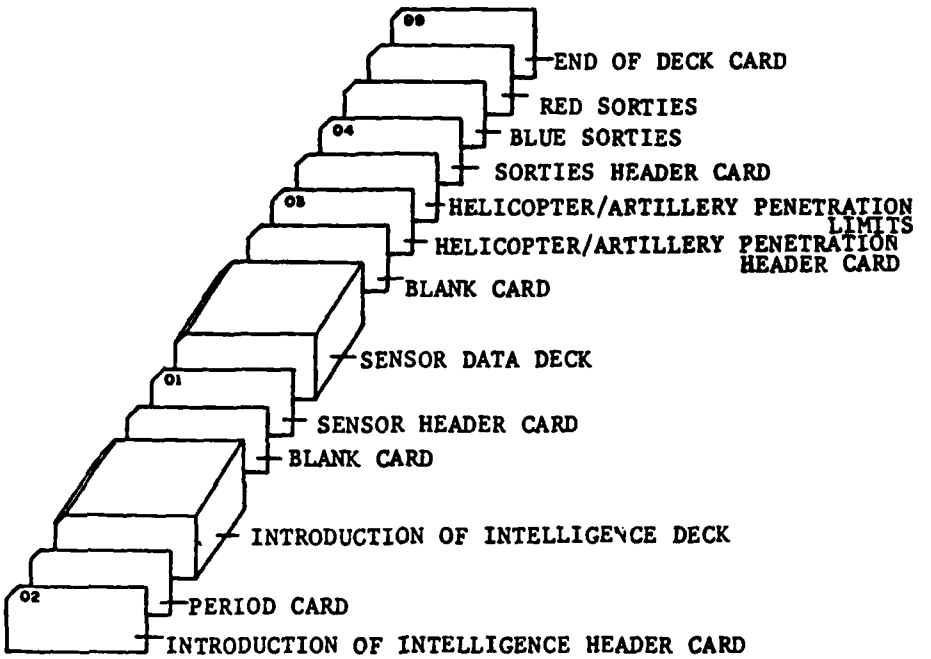


Figure C-14. Typical Data Deck Arrangement for Operating Instructions

APPENDIX D

ANALYSIS OUTPUT PROCESSOR USERS GUIDE

1. PURPOSE. The purpose of this appendix is to provide prospective users with the procedures and techniques necessary to operate the Analysis Output Processor.

2. BACKGROUND. The Analysis Output Processor is designed to reduce the volume of data produced by the Period Processor of the DIVWAG system into manageable sets of data for analysis and perform the numerical operations of the statistical process described in Analytical Methodologies, which is Volume II of the DIVWAG documentation set published in December 1971.[1] The Analysis Output Processor performs three functions:

- data extraction
- data display
- statistical calculations.

a. The data extraction and display routines of the Analysis Output Processor extract game output data from the period history tapes produced by the Period Processor and array the data. This process is accomplished utilizing computer programs that scan the complete set of game history data, extract data by type of information desired, merge the data, and array the data into the proper subsets as input for the statistical computations.

b. The statistical calculations function of the Analysis Output Processor performs the numerical operations of both the parametric and nonparametric statistical analyses of the game output. The details of the statistical analysis techniques appear in Analytical Methodologies.[1] The statistical calculation results in a final rank ordering of units and systems for each functional area of combat. A detailed description of the Analysis Output Processor is contained in Section VI of Volume III of this documentation. The procedures for using the processor are described in the following paragraphs.

3. COMPUTER INTERFACE PROCEDURES:

a. Steps in Processing. There are four major steps in using the Analysis Output Processor, excluding the step of listing some or all of the records on the period history tapes. The steps are as follows.

- History tape preparation and data extraction

1. Development of a Division War Game Model (DIVWAG), Analytical Methodologies (Volume II), USACDC Combat Systems Group study, December 1971.

- Data display
- Subjective evaluation of data
- Data correction and statistical analysis.

The first and second steps may be performed as one computer job. With the output of this job, the analyst may perform the third step and structure the input for the fourth step, which also may be run as one job. These two jobs and a third tape listing job are described in the following subparagraphs.

b. Preparation, Extraction, and Display Job. This job executes the routine PREP to preprocess the period history tapes. Routine ANCARD and one, two, or all extractor routines--AFM, AGM, and GCMOD--are used to extract data from the abbreviated preprocessed period history tape. Data are arrayed by these routines in the form required by the analysis routines, routine MTXMRG is used to display the arrays and to write the output of the extraction routines onto magnetic tape. Since the DIVWAG data file is a required input for routine ANCARD, the utility routine, UTILLD, must also be executed to load the data file onto disk.

(1) Data Card Preparation:

(a) Data Cards for Routine PREP. A single card is input to routine PREP. An example of the card format is illustrated in Figure D-1 and contains 4 to 18 input values.

1. Columns 1-2. The number of period history tapes from which records are to be selected is entered, right-justified in columns 1 and 2. In the figure, record types 111, 112, 241, 242, 311, 312, and 313 are selected from two tapes.

2. Columns 3-16. The minimum and maximum times for records to be selected are entered, right-justified, in columns 4-9 and 11-16 respectively. Columns 3 and 10 are separator columns. The minimum and maximum times are packed in the form ddhhmm, where dd is day, hh is hour, and mm is minute. See Figure D-1.

3. Columns 18-80. The 1 to 16 record types to be selected are entered in columns 18-20, 22-24, 26-28, and so forth through 78-80. Columns 17, 21, 25, 29, and so forth to 77 are ignored. Blanks, commas, dashes, or any other characters may be used as separators in these columns.

(b) Data Cards for Routine ANCARD. Eight types of input cards are recognized by routine ANCARD. They are unit identification (UID) cards, unit type designator (UTD) cards, time cards, equipment cards, quantity-rate (Q-R) cards, killer selection cards, combination cards, and the END (of input) card. For each extractor routine to be used: (1) one to ten classes (matrix rows) must be defined using UID and/or UTD cards; (2) the time intervals (matrix columns) must be defined using time cards; (3) the matrices to

SAMPLE INPUT CARD FORMAT FOR PREP

NO. OF TAPES	*	MINIMUM PACKED TIME	*	MAXIMUM PACKED TIME	*	RECORD TYPE	*	RECORD TYPE	*	RECORD TYPE	*	RECORD TYPE	*	RECORD TYPE	*	RECORD TYPE	*	RECORD TYPE	*	RECORD TYPE	*	RECORD TYPE	*	RECORD TYPE	*	RECORD TYPE	*	RECORD TYPE	*	RECORD TYPE	*	RECORD TYPE	*	RECORD TYPE
2	,	0 1 2 3 5 9	-	0 2 0 8 0 0	,	1	,	1	,	2	,	4	,	2	,	4	,	2	,	3	,	1	,	3	,	2	,	3	,	3	.			

* Seperator

Figure D-1. Input Card Format for Routine PREP

be constructed must be defined using equipment cards for AFM/AGM and/or killer selection cards (and optionally combination cards) for GCMOD; and (4) the kinds of matrices must be defined using Q-R cards. The last card in the input deck must be an end card. Diagnostics are not issued if input for one or more extractor routines is incomplete, and this condition is not fatal to execution of routine ANCARD (and may not be fatal to execution of the extractor routine). It is the responsibility of the user to insure that the input is complete. The formats and data for each of the eight card types are discussed in the follow'ng subparagraphs. A combined example of the input cards for routine ANCARD is shown in Figure D-2.

1. UID Card. This card defines a row (class) by UID of the units to be included.

a. Model to be Selected (Columns 1-2). This entry may be 01, 02, or 03, where 01 is the Area Fire Model, 02 is the Air Ground Engagement Model, and 03 is the Ground Combat Model.

b. Card Type (Column 3). The number 1 must be entered in column 3.

c. Class (or Row) to Which UID Card Applies (Columns 4-5). The class (1-10) is entered, right-justified, in these columns.

d. UID to be Selected (Columns 11-18, 20-27, 29-36, 38-45, 47-54, 56-63, and 65-72). A UID must contain eight alphanumeric characters and begin with B or R. An exception is if the class is to contain all Blue or all Red units, wherein the mnemonic ALLB or ALLR respectively is entered in columns 11-14.

e. Additional Cards. Additional cards, prepared as above, are required when more than seven UIDs are to be defined in one class.

2. UTD Card. This card defines a row (class) by UTD of the units to be included.

a. Model Code Number (Columns 1-2). The entry is 01, 02, or 03.

b. Card Type (Column 3). The number 2 is entered.

c. Class (or Row) of Matrix to Which UTD Card Applies (Columns 4-5). The class (1-10), right-justified, is entered.

d. UTD to be Selected (Columns 11-14, 16-19, 21-24, and so Forth to 71-74). A UTD must be four alphameric characters, and is entered in these columns.

e. Additional Cards. Additional cards, prepared as above, are required when more than 13 UTDs are specified.

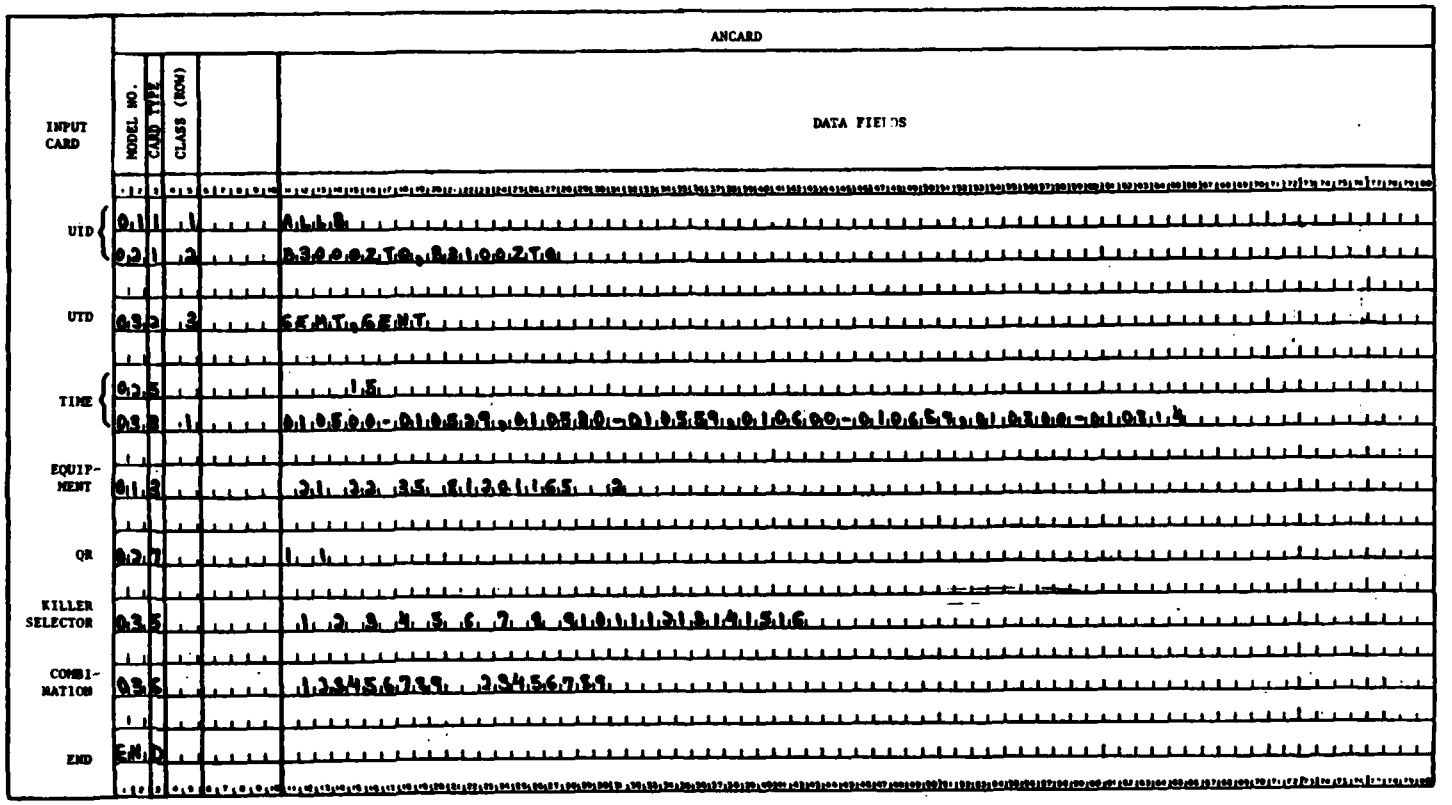


Figure D-2. Format of Input Cards for Routine ANCARD

3. Time Card. The time card defines the matrix columns, (i.e., the length of the time interval for the Area Fire and Air Ground Engagement Model matrices, and the individual interval end points for each column of the Ground Combat Model matrices). The Area Fire and Air Ground Engagement Models require only one time card each specifying the length of the interval; however, the Ground Combat Model requires at least one time card for each row (class).

a. Model Code Number (Columns 1-2). The entry can be 01, 02, or 03.

b. Card Type (Column 3). The number 4 is entered for the Area Fire Model time card. The number 5 is entered for the Air Ground Engagement Model. The number 3 is entered when the time card applies to the Ground Combat Model.

c. Class (or Row). to Which the Times Apply (Columns 4-5). This field is applicable only to Ground Combat time cards. For other models, all classes have the same time intervals.

d. Time Interval in Minutes (Columns 11-16). This field applies only to the Area Fire and Air Ground Engagement Models. Enter the length of the time interval (right justified) in minues to be used.

e. Ground Combat Model Time Interval Boundary Specifications (Columns 11-16 and 18-23, 25-30 and 32-37, 39-44 and 46-51, and 53-58 and 60-65). Two entries are required to define a time interval, and each card allows the specification of four time intervals for a Ground Combat Model class. The first entry of each pair of columns on the card is the interval starting time, and the second is the interval ending time. The times must all be in ascending order on each Ground Combat Model time card. The first Ground Combat Model time card encountered will specify time intervals for the first four entries in a row; the second card encountered for that row (class) specifies the time intervals for the next four entries, etc. A dash or hyphen may be used between the times defining a time interval, and a comma may be used to separate interval pairs; however, both hyphens and commas are optional.

4. Equipment Card. This card is used to specify equipment types for which each analysis matrix is to be build.

a. Model Code Number (Columns 1-2). The entry can be 01 (Area Fire) or 02 (Air Ground Engagement) only.

b. Card Type (Column 3). The entry must be 3.

c. Equipment Number for Which a Matrix Should Be Built (Columns 11-13, 14-16, ..., 74-76, and 77-79). Equipment numbers must be right justified.

d. Additional Cards. Additional cards, prepared as above, are required when the equipment types for which matrices are being build exceed 23 items (maximum is 25).

5. Quantity-Rate (Q-R) Cards. The Q-R card is used to select matrices containing data in quantity or rate form for either losses or effects.

a. Model Number (Columns 1-2). Entry can be 01, 02, or 03.

b. Card Type (Column 3). Enter 5 for Area Fire, 7 for Air Ground Engagement, or 4 for Ground Combat.

c. Quantity of Losses (Column 11). Enter 1 if quantity of losses matrices are desired. Leave blank if matrix is not desired.

d. Rate of Losses (Column 12). Enter 1 if rate of losses matrices are desired. Leave blank if matrix is not desired.

e. Quantity of Effects (Column 13). Enter 1 if quantity of effects matrices are desired. Leave blank if matrix is not desired.

f. Rates of Effects (Column 14). Enter 1 if the rates of effects matrices are desired. Leave blank if matrix is not desired.

6. Killer Selection Card. This card is used to select the killers whose victims are to be used in building Ground Combat analysis matrices.

a. Model Number (Columns 1-2). These columns must have 03 entered since this card is applicable only to the Ground Combat Model.

b. Card Type (Column 3). The column must have 5 entered.

c. Mnemonic or Comment (Columns 4-10). Optional entry.

d. Killer Ordinal (Columns 11-12, ..., 41-42). The killer ordinal refers to the row number of the killer in the killer-victim matrix output by the Ground Combat Model in the Period Processor technical output. The ordinal may have a value from 1 to 16 and is right justified.

7. Combination Card. The combination card is used to inform the Ground Combat Model data extractor how to combine (matrix addition) Ground Combat Model victim matrices.

a. Model Number (Columns 1-2). The entry must be 03.

b. Card Type (Column 3). The entry must be 6.

c. Combined Matrix Definition (Columns 11-20, 21-30, 31-40, ..., and 61-70). Each 10-column group may contain any combination of numbers from 1 to 9. The matrix for each of the victims specified in a group are added together and the sum matrix will be subjected to analysis as well as each of the nine victim matrices.

8. End Card. A card with END in columns 1-3 is required to signify the end of the data deck.

(c) Data Card for Routine AFM. No card input is required if only one abbreviated period history tape created by one of the tape preprocessors is to be input. If more than one history tape is to be input, a single card with the number of history tapes to be input right justified in columns 9 and 10 is required.

(d) Data Card for Routine AGM. No card input is required if only one abbreviated period history tape created by one of the tape preprocessors is to be input. If more than one history tape is to be input, a single card with the number of history tapes to be input right justified in columns 9 and 10 is required.

(e) Data Card for Routine GCMOD. No card input is required if only one abbreviated period history tape created by one of the tape preprocessors is to be input. If more than one history tape is to be input, a single card with the number of history tapes to be input right justified in columns 9 and 10 is required.

(2) Deck Structure. Figure D-3 illustrates the control cards and input decks required to execute the first two steps of the Analysis Output Processor. In this example, all three extractor routines are executed.

(3) Job Request Form. Figure D-4 shows the job request form to accompany the job of the previous example.

(4) Discussion:

(a) Control Cards. The job of this example, XTRCT, requires 120,000 (octal) words of central memory, the central processing unit (CPU) time limit is set to 777 (octal) seconds. One nine-track tape drive and one seven-track drive are used. The first task the job performs is to retrieve, from the disk library, the executable binary routines, copy six complete routines, and return the library to the system. The Period Processor dump tape is mounted on a nine-track tape drive and the utility routine, UTILLD, is attached and executed to load the DIVWAG data file onto disk. The dump tape is unloaded and the file, UTILLD, is returned to the system. The third task is execution of routine ANCARD. This task is performed before the preprocessing step to minimize the amount of disk storage the job controls at any one time. Following execution of ANCARD, the disk area into which the DIVWAG data file was loaded and the routine are returned to the system. The fourth

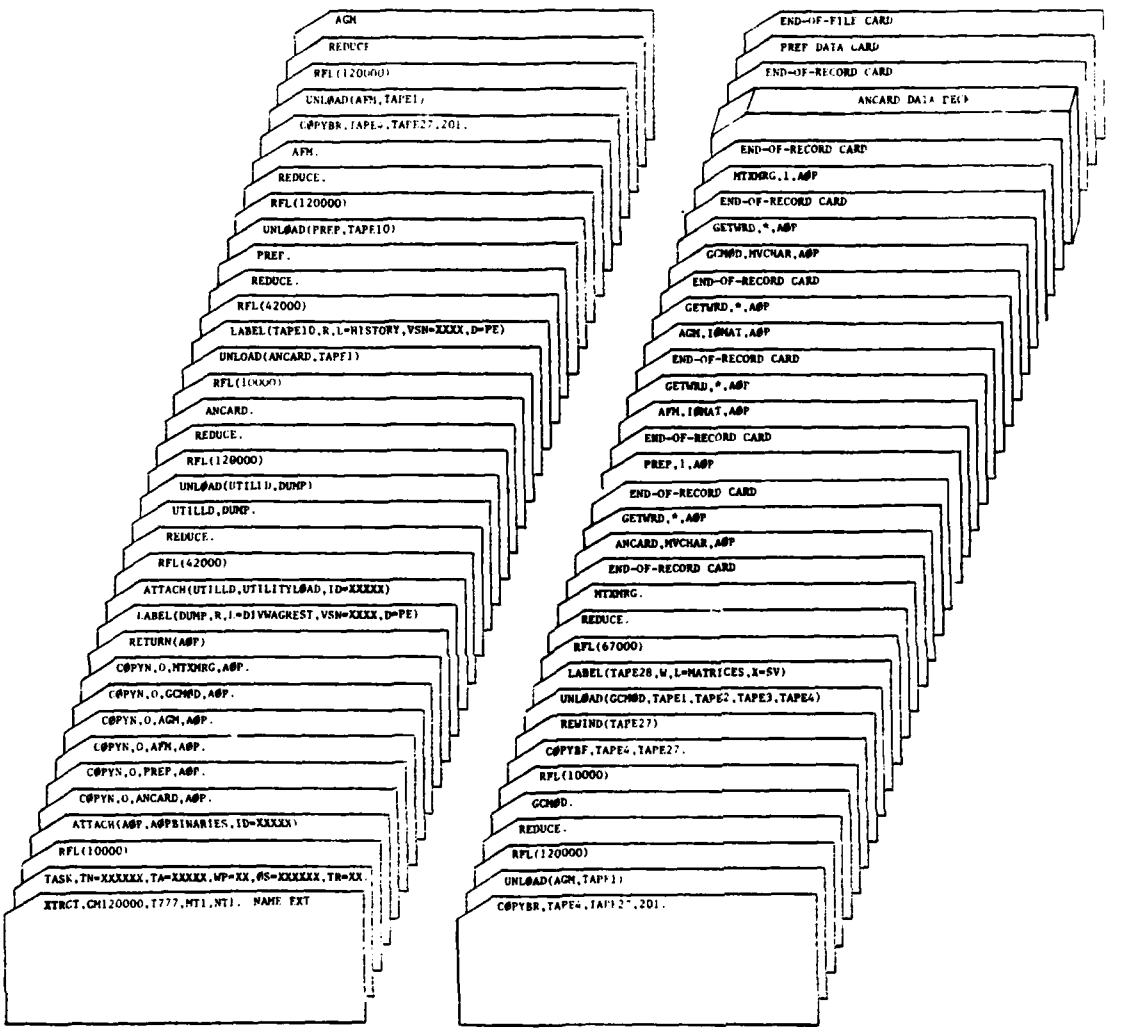


Figure D-3. Preparation, Extraction, and Display Deck Structure

ADP-F WORK REQUEST FORM

1 PROJECT	2 CORE	3 JOB NAME	4 PROGRAMMER	5 PHONE NO
XXXXXX	120K	XTRCT	XXXXXXX	XXXX
6 TIME ESTIMATE (MIN)	**7 OPERATOR**	**8 SECURITY CLASSIFICATION**	**9**	**10 SEQ NO**
75		U		

11 TYPE OF JOB	12 NO REEL/DISK	13 PHYS UNIT	14 LUN/DSI	15 INPUT	16 OUTPUT	17 RESERVE	18 LABEL NOT TO EXCEED 20 CHARS
TEST & DEBUG ☐							
PRODUCTION ☒							
TIMES	XXXX	NT	10	X			HISTORY
19 IN FACILITY	XXXX	NT	DUMP	X			DIVWAGREST
20 OFF	XXXX	MT	28		X	XXXX	MATRICES
21 ON							
22. OFF (RERUN)							
23 ON (RERUN)							
24 OUT OF FACILITY							

25 ADDITIONAL OPERATING INSTRUCTIONS

PUNCHED OUTPUT ☐ BINARY ☐

TYPE OF DUMP _____

26 OPERATOR'S COMMENT

SEE INSTRUCTIONS ON BACK

Figure D-4. Sample Work Request Form for Preparation, Extraction, and Display

task is preprocessing. The first period history tape is mounted on a nine-track tape drive. The routine PREP is executed. The remaining period history tapes are mounted, in turn, on the same tape drive under program control during this execution. Following execution of PREP the last history tape is unloaded, and the routine and tape drive are returned to the system. The fifth task, data extraction, is performed by routines AFM, AGM, and GCMOD. These routines operate on input disk files TAPE2 and TAPE3 created by routines ANCARD and PREP respectively, and utilize large disk scratch files (TAPE1) during execution. After each execution in this task, the routine executed and the scratch file are returned to the system and the output file, TAPE4, is copied to another disk file, TAPE27, to be used as input for the next task. The final task, data display, is performed by routine MTXMRG. An output tape, TAPE28, is mounted on a seven-track drive and the program is executed.

(b) Input. The data deck illustrated in Figure D-3 corresponds to a file contining nine records. The first record is the deck of control cards discussed above. The second through seventh records are COPYN instruction cards; i.e., input for the routine COPYN which is executed six times during the first task. The routine UTILLD, executed during the second task, requires no input; the eighth record is the input deck for routine ANCARD. The final record is the input card for PREP. The extractor routines and routine MTXMRG default to the correct input for execution if there are no input cards; i.e., the extractors expect the single abbreviated period history file created by routine PREP, and routine MTXMRG expects one input file containing the combined output of the extractor programs.

c. Data Correction and Statistical Analysis. This job executes routine MTXUP to replace nonsignificant entries in the matrices with null numbers and routine ANALYS to perform the statistical calculations.

(1) Data Card Preparation:

(a) Data Cards for Routine MTXUP. A number-of-tapes card and any number of update data cards are input for routine MTXUP. These card types are described in the following subparagraphs.

1. Number-of-Tapes Card. The number of tapes to be input is entered in columns 4 and 5.

2. Update Data Card. Five values are entered on each update data card. They are the output record number (EI number) of the matrix to be updated (columns 1-5). The model code--01, 02, or 03--of the extractor routine which created the record (columns 6-10), the column (columns 11-15) and row (columns 16-20) of the zero entry in the matrix to be updated, and the new value of the entry (columns 23-27). All values must be right justified in the indicated columns. The update cards must be sequenced in ascending order by output record number. Figure D-5 shows an example of an update card.

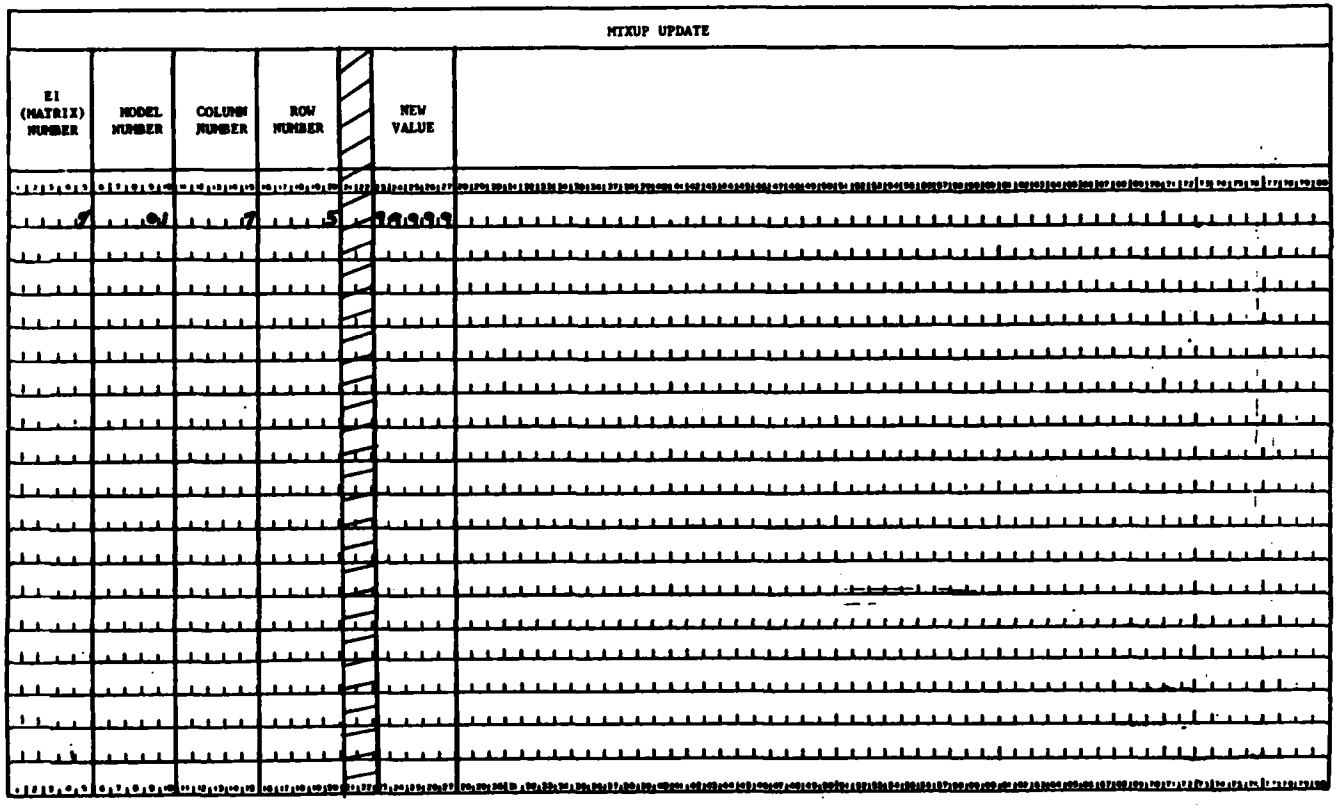


Figure D-5. Update Data Card for Routine MTXUP

(b) Data Cards for Routine ANALYS. Routine ANALYS requires a number-of-tapes card and two data cards per effectiveness measure partition for each partition to be calculated. These input cards are described in the following subparagraphs.

1. Number-of-Tapes Card. This card indicates the number of tapes to be input in columns 4 and 5.

2. Data Cards. For each effectiveness measure partition, a card indicating the effectiveness measure number (columns 3-4) and the output record numbers of the matrices (effectiveness indicator number) which make up the partition (columns 11-13, 14-16, ..., 68-70), and a card indicating the desired level of confidence (alpha level) must be input. The level is indicated by the following code numbers in column 5 of the card.

Code	Alpha Level
1	0.10
2	0.20
3	0.30
4	0.40
5	0.50

All input values are right justified in the indicated columns of the cards. See Figure D-6 for an example of the first card type described above.

(2) Deck Structure. Figure D-7 shows the control cards and input decks to execute this job.

(3) Job Request Form. Figure D-8 shows the job request form to accompany the above example.

(4) Discussion:

(a) Control Cards. The job of this example, ANALYS, requires 120,000 (octal) words of central memory. The central processing unit (CPU) time limit is set to 177 (octal) seconds. One seven-track tape drive is used. The first task the job performs is to retrieve, from the disk library, the executable routines, copy the two complete routines--MTXUP and ANALYS--and return the library to the system. The output tape from the previous job is mounted on a seven-track drive, routine MTXUP is executed, and the tape, tape drive, and routine are returned to the system in the second task. The final task is execution of routine ANALYS.

(b) Input. The deck in Figure D-7 corresponds to a file containing five records. The first record is the deck of control cards. The second and third records contain the COPYN instruction cards; i.e., input for the two executions of the routine COPYN. The fourth record is the input deck for routine MTXUP, and the final record is the input deck for routine ANALYS.

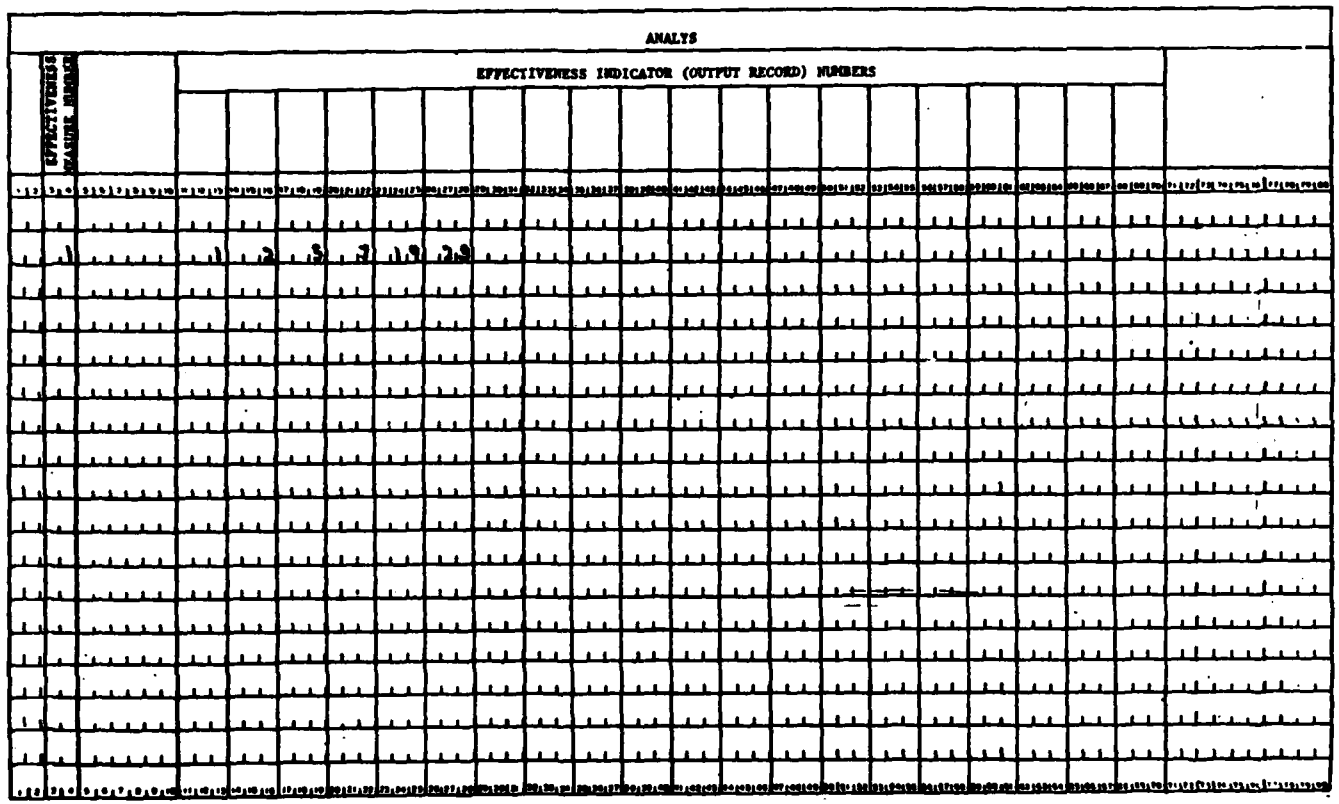


Figure D-6. Input Card for Routine ANALYS

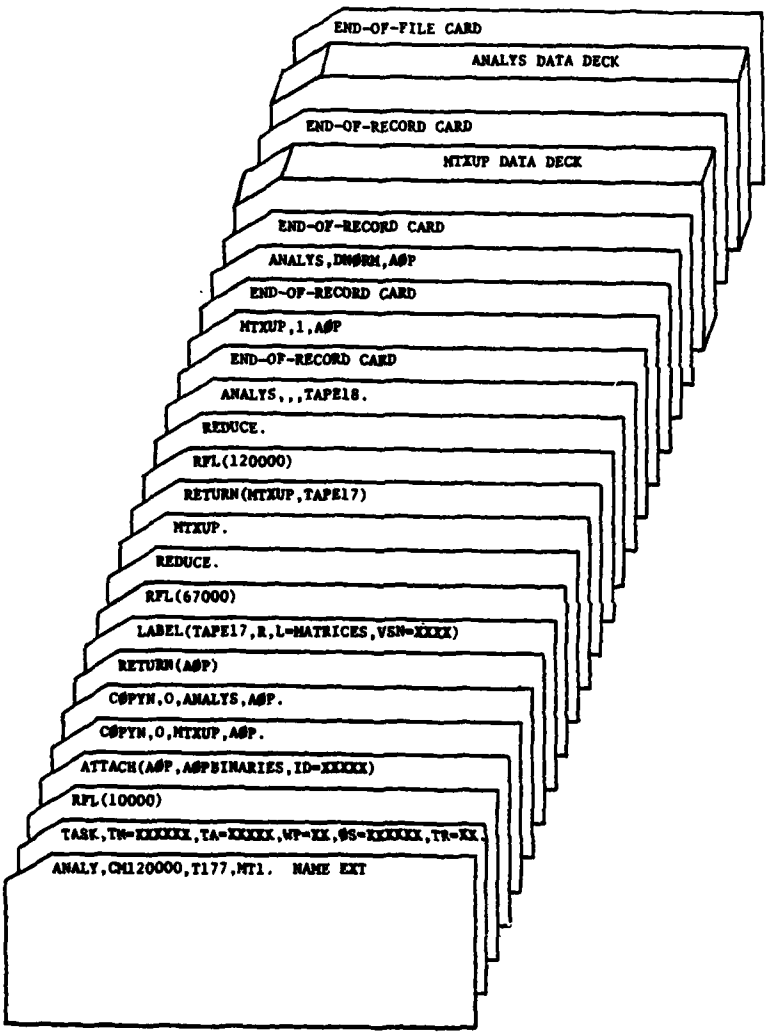


Figure D-7. Data Correction and Statistical Analysis Deck Structure

ADP-F WORK REQUEST FORM

1 PROJECT	2 CORE	3 JOB NAME	4 PROGRAMMER	5 PHONE NO
XXXXX	120K	ANALY	XXXXX	XXXX
6 TIME ESTIMATE (MIN)	**7 OPERATOR**	**8 SECURITY CLASSIFICATION**	**9**	**10 SEQ NO**
10		U		

11 TYPE OF JOB	12 NO REEL/DISK	13 PHYS UNIT	14 LUN/DSN	15 INPUT	16 OUTPUT	17 RESERVE	18 LABEL NOT TO EXCEED 20 CHARS
TEST & DEBUG ☐ PRODUCTION ☒							
TIMES	XXXX	MT	17	X			MATRICES
19 IN FACILITY							
20 OFF							
21 ON							
22 OFF (RERUN)							
23 ON (RERUN)							
24 OUT OF FACILITY							

25 ADDITIONAL OPERATING INSTRUCTIONS
PUNCHED OUTPUT ☐ BINARY ☐
TYPE OF DUMP _____

26 OPERATOR'S COMMENT

SEE INSTRUCTIONS ON BACK

Figure D-8. Sample Work Request Form for Data Correction and Statistical Analysis

d. Tape Listing Job. Any number of period history tapes created by the Period Processor or abbreviated period history tapes created by either of the preprocessor routines, PREP or PTAPE, may be listed by the tape listing routine, PHIST. The following example shows the technique used to generate an abbreviated period history tape using routine PTAPE and list it. Since routine PTAPE uses the output of routine UXR, and routine UXR requires the DIVWAG data file, which must be loaded to disk using routine UTILLD, these two routines are also executed.

(1) Data Card Preparation:

(a) Data Cards for Routine UXR. No card input is required.

(b) Data Cards for Routine PTAPE. An input tapes data card, 1 to 50 sets of selection criteria cards, and an end selection criteria card are required.

1. Input Tapes Data Card. The first input card contains two integer values. The first value, right-justified in column 10, is the number of period history tapes from which records are to be selected. The second value, right-justified in column 20, is 1 for normal executions or 2 if duplicate sets of period history tapes are to be input.

2. Selection Criteria Sets. Each set contains at least two cards; any number (including zero) of selection criteria cards, a device card, and an end card. All cards are free form; blanks are ignored. Four types of selection criteria cards are allowed, and are described in the following subparagraphs.

a. Unit Identification (UID) Criteria Card. The UID criteria card allows the user to select event records of a single unit or a set of units by specifying the appropriate UIDs. The format of the card requires the key characters "UID =" followed by the unit identifications which must be separated by commas. The card size limits the number of eight-character UIDs on one card to seven; however, any number of UID cards may be included in a set, and one to seven UIDs may be on any card. The maximum number of units is 100. If it is desired to select all of the units in either the Blue force or Red force, the form of the card is UID = ALLB for Blue or UID = ALLR for Red. If no UID card is included in a criteria set, all units are acceptable dependent on the other criteria.

b. Unit Type Designator (UTD) Criteria Card. The UTD criteria card allows the selection of a single unit type or a set of unit types by listing appropriate UTDs. The format of the UTD card requires the key characters "UTD=" followed by the UTDs which must be separated by commas. UTDs may be either actual four-character UTDs or partial UTDs, in which one to three of the UTD characters are masked with asterisks (*) to indicate that only the unmasked characters are significant. The card size limits the number of UTDs on one card to 15; however, any number of UTD cards may be included

in a set, and any number of UTDs may be on any one card. The limiting constraint is that the number of units should not exceed 100. If no UTD card is included in a criteria set, all unit types are acceptable dependent on the other criteria.

c. Time (TIM) Criteria Card. Game time may be applied as a criterion for the selection of event records by use of the TIM criteria card. The format of the TIM criteria card requires the key characters "TIM =" followed by time intervals with separating commas. The time intervals must be in the form ddhhmm-ddhhmm, where ddhhmm indicates the day/hour/minute form of game time, and the earlier time must be on the left. The number of time intervals on one card is limited to six by card size; however, multiple cards may be used. The maximum number of time intervals allowable per set is 15. If no TIM criteria card is included in a criteria set, time is not a criterion for selection.

d. Class (CLS) Criteria Card. The CLS criteria card may be used to select event records according to class; i.e., DIVWAG model source. The format of the CLS card requires the key characters "CLS =" followed by a list of class codes separated by commas. Desired classes should be expressable on one card. The following valid class codes pertain to the model that is the source.

Class Code	Model
1	Area Fire
2	Air Ground Engagement
3	Ground Combat
4	Intelligence and Control
5	Combat Service Support
6	Movement
7	Engineer

e. Device (DEV) Card. The user specifies the device number (also termed data set identifier (DSI)) to which the selected records will be written for the criteria set by using the DEV card. Allowable device numbers are 1, 2, 3, 4, and 5. The format requires the key characters "DEV =" followed by the device numbers separated by commas, if more than one.

f. End Set Card. Only the key characters "END" are required.

3. End of Selection Criteria Card. This card is identical in format to the end of set card.

4. Card Format Example. Figure D-9 shows a data card set example. In this figure, records are selected from two period history tapes. The duplicate input option is not used. There are four sets of selection criteria, and four output tapes are generated. The first set of selection

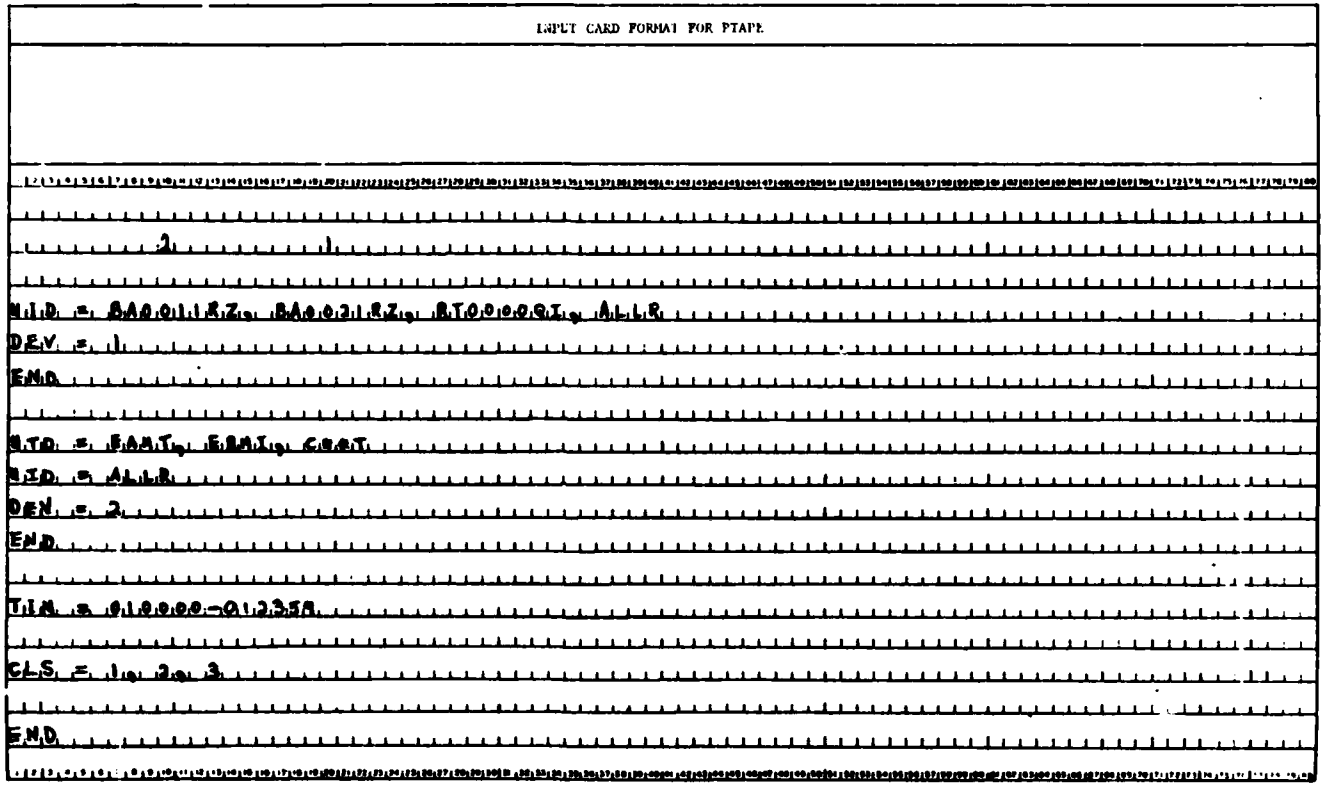


Figure D-9. Input Card Format for PTAPE

criteria causes all records of three Blue units and all Red units to be written on DSI 1. The second set causes all records of unit types EAMT, EBMI, and those units with UTD beginning with C and ending with T, as well as all Red units to be written on DSI 2. The third set causes all records for Day 1 to be written on DSI 3. The last set causes all records from the Area Fire, Air Ground Engagement, and Ground Combat Models to be written on DSI 4.

(c) Data Cards for Routine PHIST. A single card is input to routine PHIST. The card contains three values, the minimum and maximum times for records to be listed and the number of period history tapes to be input. The times are packed times; i.e., in the form ddhhmm, where dd is day, hh is hour, and mm is minute.

1. Columns 1-21. The minimum time is entered, right justified in columns 1-6. The maximum time is entered, right justified in columns 10-15. Columns 20-21 contain the number of tapes, right justified.

2. Columns 7-9, 16-19, and 22-80. These columns are ignored; however, characters may be entered as separators or comments in these columns.

3. Card Format Example. Figure D-10 shows a sample data card for routine PHIST.

(2) Deck Structure. Figure D-11 shows the control cards and input decks to execute this job.

(3) Job Request. Figure D-12 shows the work request form to accompany the above deck.

(4) Discussion:

(a) Control Cards. The job of this example, HIST, requires 120,000 (octal) words of central memory. The central processing unit (CPU) time limit is set to 177 (octal) seconds. One nine-track tape drive is used. The first task the job performs is to retrieve, from the disk library, the executable routines, copy the three routines to be executed, and return the library to the system. In the second task, the Period Processor dump tape is mounted on a nine-track tape drive, and the DIVWAG data file is loaded to disk by routine UTILLD. The tape drive and routine UTILLD are returned to the system. The third task is the execution of routine UXR and the release of the routine and disk file used. The fourth task, performed by routine PTAPE, is the creation of an abbreviated period history tape. It is assumed that the input has defined only one qualifier set and instructed that records meeting the selection criteria for this set will be written to the disk file, TAPE2. The final task is to list TAPE2 using routine PHIST.

(b) Input. The deck in Figure D-11 corresponds to a file containing six records. The first record is the deck of control cards. The next three records are COPYN instruction cards; i.e., input for the three

INPUT CARD FOR PHIST

MINIMUM TIME	SEPA-RATOR	MAXIMUM TIME	SEPA-RATOR	NO. OF TAPES	COMMENTS
0.0	=	1.92E+09	=	0.2	INPUT CARD FOR PHIST

Figure D-10. Input Card for Routine PHIST

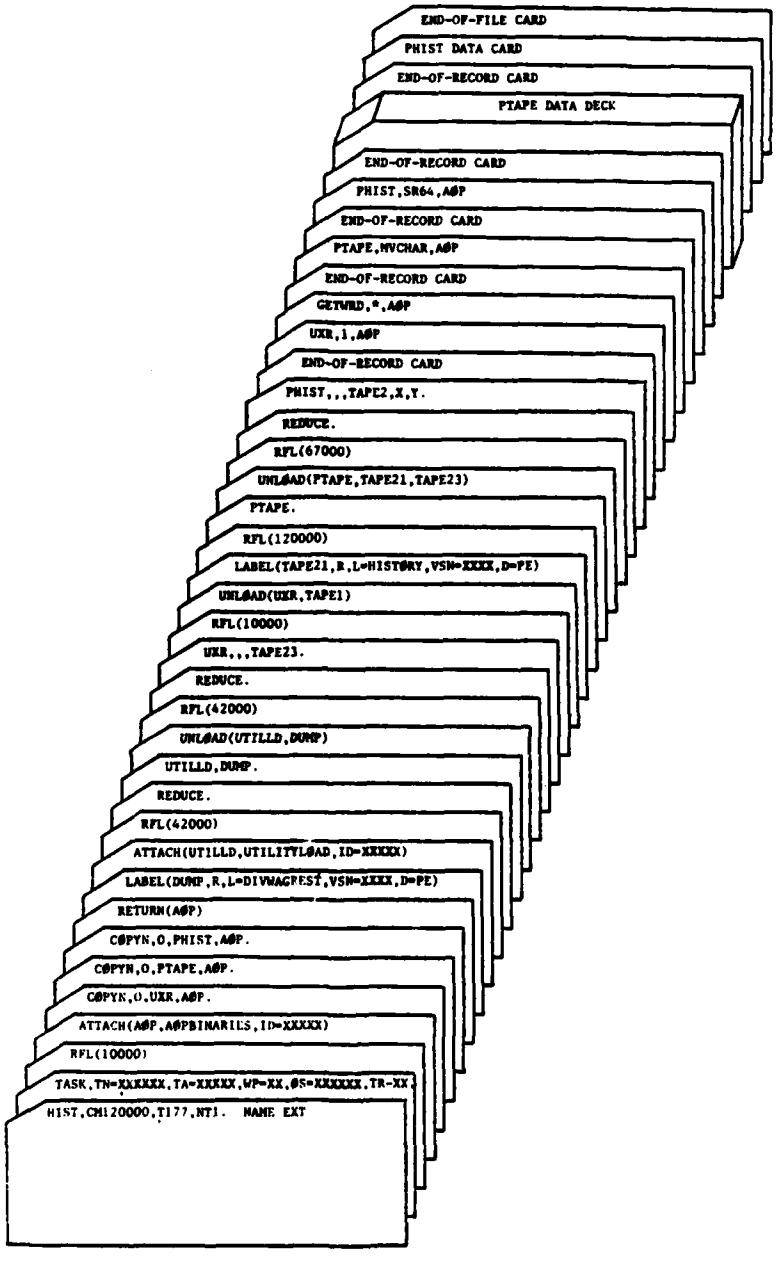


Figure D-11. Tape Listing Deck Structure

ADP-F WORK REQUEST FORM

1 PROJECT	2 CORE	3 JOB NAME	4 PROGRAMMER	5 PHONE NO
XXXXX	120K	HIST	XXXX	XXXX

6 TIME ESTIMATE (MIN)	7 OPERATOR	8 SECURITY CLASSIFICATION	9	10 SEQ NO
25		U		

11 TYPE OF JOB	12 NO REEL/DISK	13 PHYS UNIT	14 LUN/DS	15 INPUT	16 OUTPUT	17 RESERVE	18 LABEL NOT TO EXCEED 20 CHARS
TEST & DEBUG ☐ PRODUCTION ☒							
TIMES	XXXX	NT	21	X			HISTORY
19 IN FACILITY	XXXX	NT	DUMP	X			DIVWAGREST
20 OFF							
21 ON							
22 OFF (RERUN)							
23 ON (RERUN)							
24 OUT OF FACILITY							

25 ADDITIONAL OPERATING INSTRUCTIONS

PUNCHED OUTPUT ☐ BINARY ☐

TYPE OF DUMP _____

26. OPERATOR'S COMMENT

SEE INSTRUCTIONS ON BACK

Figure D-12. Sample Work Request Form for Tape Listing

executions of the routine COPYN. Routines UTILLD and UXR have no card input so the fifth record is the input deck for routine PTAPE. The final record is the input card for routine PHIST.

END

DATE
FILMED
4-82

DTIC